OCR
Oxford Cambridge and RSA

H

GCSE (9–1)

Combined Science A (Physics) A (Gateway Science)

J250/11: Paper 11 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

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.

1. 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

2. 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

3. **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.

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

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	[1 before 5] 5 before 4 ✓ 4 before 3 ✓ [3 before 2]	2	2 × 1.1	
	(a)	(ii)	Peer Review **Any one from:** to confirm the experiment is reproducible ✓ to check the method ✓ to check for mistakes ✓ to ensure quality of research / uphold standards / prevent unethical behaviour ✓ to offer advice by experts ✓ Communication **Any one from:** other scientists can check / test / verify / validate results (against own results) ✓ other scientists can develop or use ideas or theories ✓ others can use or compare the data ✓ improve knowledge or education ✓ more data available / allow further development or research ✓ to gain credit or acknowledgement for their work ✓	2	2 × 3.2a	**ALLOW** to check it is carried out correctly **IGNORE** to see if others think the same **ALLOW** to ensure the experiments are performed correctly / to know of any downfalls / checking the findings / check the validity / to cross check **ALLOW** to detect false claims **ALLOW** to add more ideas/points / to give another opinion **ALLOW** to make corrections **ALLOW** other investigations or experiments could be done afterwards / for more opinions and theories **ALLOW** to see similarities and differences **ALLOW** help with new technologies

Question			Answer	Marks	AO element	Guidance
11	(b)	(i)	**Any two from:** Density of solids is the greatest / AW ✓ Density of gases is the least / AW ✓ Density of solids > density of liquids / ORA ✓ Density of solids > density of gases / ORA ✓ Density of liquids > density of gases / ORA ✓	**2**	**2 × 3.1a**	
		(ii)	Atoms more tightly packed in a solid than liquid / ORA ✓ So greater mass in the same volume / ORA ✓	**2**	**2 × 1.1**	**ALLOW** answers on a labelled diagram
	(c)	**(i)**	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 169 200 (J) award 2 marks** E = 0.2 × 846 000 ✓ E = 169 200 (J) ✓	**2**	**2 × 2.1**	
		(ii)	Increasing temp (of 1kg of water by 1°C) only requires molecules to move faster ✓ Evaporation requires intermolecular forces to be overcome ✓	**2**	**2 × 2.1**	**ALLOW** increases the kinetic energy of molecules **ALLOW** to break (intermolecular) bonds

Question			Answer	Marks	AO element	Guidance
12	(a)		Rate or how fast work is done, or energy is transferred / AW ✓	1	1.1	
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 908 (N) award 3 marks** 200 lbs = 200 × 0.454 kg = 90.8 (kg) ✓ W = 90.8 × 10 ✓ W = 908 (N) ✓	3	1.2 2 × 2.1	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 248 (W) award 4 marks** W = 620 × 1.6 ✓ W = 992 (J) ✓ P = 992 / 4 ✓ P = 248 (W) ✓	4	4 × 2.1	**ALLOW** ecf for incorrect work done for MPs 3 and 4

Question			Answer	Marks	AO element	Guidance
13	*		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 statements in terms of distance, displacements and velocity. **AND** Calculations included to explain answer. *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)** Detailed evaluation of statements in terms of distance, displacements and velocity. **OR** Outline evaluation of statements in terms of distance, displacements and velocity. **AND** An attempt to include calculations to explain answer. *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)** Evaluation of statements in terms of distance OR displacements OR velocity. **OR** Calculations included to explain answer. *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 × 1.1 4 × 3.1b	**AO3.1b – Analyses information to evaluate speed and velocity** • Distance = 90 m • Displacement = 18 m • S = distance / time = 90/120 = 0.75 m/s • V = displacement / time = 18/120 = 0.15 m/s • Velocity < speed • Displacement < distance • Therefore, the statements are false **AO1.1 – Demonstrates knowledge of vector and scalar distinction as it applies to speed, velocity, distance, displacement** • Velocity = displacement / time • Speed = distance / time • Displacement = shortest distance between 2 points in a certain direction • Velocity and displacement are vectors as they have direction

Question			Answer	Marks	AO element	Guidance
14	(a)		 Force of floor on ball / Normal contact/reaction ✓ Force of ball on floor / Weight ✓	2	2 × 2.2	**ALLOW** for one mark if no other marks awarded, arrows of same size in opposite directions vertically and forces labelled in some incomplete way e.g., force of floor, force of ball
	(b)	(i)	First **AND** Forces on ball are balanced / resultant force = 0 ✓	1	1.1	**BOTH** needed.
		(ii)	Third ✓ Forces act in pairs ✓ Force of foot on ball = force of ball on foot / one force acts on foot / AW ✓	3	1.1 2 × 2.1	 **ALLOW** equal and opposite reaction
	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 500 (m / s^2) award 2 marks** acceleration = 25 / 0.05 ✓ acceleration = 500 (m / s^2) ✓	2	2 × 2.1	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 480 (m / s^2) award 3 marks** Rearrangement: acceleration = force ÷ mass ✓ acceleration = 216 / 0.45 ✓ acceleration = 480 (m / s^2) ✓	3	1.2 2 × 2.1	

Question			Answer	Marks	AO element	Guidance
15	(a)		Voltmeter **AND** 0.1 (V) ✓	1	1.1	**BOTH** needed. **IGNORE** unit
	(b)		Complete circuit **AND** cell/battery/power source ✓ Voltmeter in parallel with resistor **AND** ammeter in series with resistor ✓ Correct symbol for resistor ✓	3	3 × 1.2	
	(c)	(i)	3.3 (V) ✓ 44 (mA) ✓	2	2 × 1.2	**ALLOW** 0.044 or 44 × 10^{-3} or 4.4 × 10^{-2} but only if units amended to A on answer line
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 75 (Ω) award 3 marks** Recall and rearrange: Resistance = p.d. ÷ current ✓ R = 3.3 / 0.044 ✓ R = 75 (Ω) ✓	3	 1.2 2 × 2.1	**ALLOW** ECF from values of p.d and current in (c)(i) **ALLOW** 0.075 (Ω) when using value of current in mA rather than A for 2 marks

Question			Answer	Marks	AO element	Guidance
15	(d)	(i)	Wire will get hot when current flows / temperature of wire will increase ✓ **Any one from:** Water reduces risk of burns ✓ To keep wire at constant temperature ✓ To keep resistance of wire constant ✓	2	2 × 3.3a	**IGNORE** no energy lost / more current / less current **ALLOW** stabilises the temperature
		(ii)	**Any two from:** Allows p.d. across wire to be varied ✓ Allows repeat readings ✓ Allows mean resistance to be calculated ✓ Allows (I-V) graph to be plotted ✓ Can check if wire has linear dependence (on p.d.) ✓	2	2 × 3.3b	

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