OCR
Oxford Cambridge and RSA

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GCSE (9–1)

Combined Science (Physics) A (Gateway Science)

J250/06: Paper 6 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

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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.

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

11. 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

12. **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.

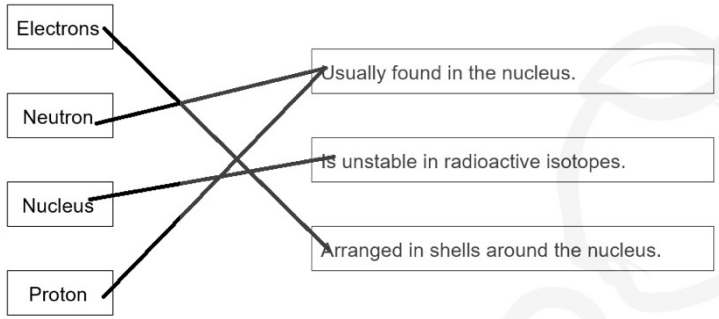
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

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

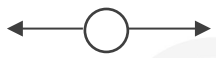
The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A:

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

Question			Answer	Marks	AO element	Guidance
11	(a)			3	3 × 1.1	All 4 correct ✓✓✓ Any 3 correct ✓✓ Any 2 correct ✓
	(b)	(i)	Stays the same / AW ✓	1	2.1	
		(ii)	Lead (lined metal container) ✓	1	2.1	**ALLOW** concrete
	(c)		Place X near object (but not touching it) ✓ Allow radiation from X to reach object / AW ✓	2	2 × 1.2	
	(d)	(i)	Plastic bottle **AND** Does not break easily / is waterproof /secure lid/ AW ✓	1	3.1b	**BOTH** needed **ORA** for cardboard box
		(ii)	Alpha ✓	1	3.2b	
	(e)	(i)	50 (%) **AND** 25 (%) ✓	1	2.2	**BOTH** needed
		(ii)	Because the amount halves after 5 days / AW✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
12	(a)	(i)	Distance taken to stop after the driver presses the brakes / AW ✓	1	1.1	
		(ii)	12 (m)	1	2.1	
	(b)		(Idea of) Energy is transferred / moved between stores / AW✓ (Idea of) Energy before = Energy after / No energy is "lost" / AW ✓	1 1	2 × 2.1	**ALLOW** the energy transferred from the kinetic (store) to the thermal (store) AW ✓ **ALLOW** the energy transferred from the kinetic store to the thermal store is equal / AW ✓✓
	(c)		Gravitational/Thermal Kinetic/Thermal Thermal	3	3 × 2.1	All 3 correct ✓✓✓ Any 2 correct ✓✓ Any 1 correct ✓
	(d)	(i)	Thermometer ✓	1	1.2	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 5000 (J) award 2 marks** E = 0.5 × 500 × 20 ✓ E = 5000 (J) ✓	2	2 × 2.1	

Question			Answer	Marks	AO element	Guidance
13	(a)	(i)	(Frequency is) number of waves in a given time ✓	1	1.2	**ALLOW** e.g. waves per second
		(ii)	(Frequency =) 1 Hz ✓	1	1.1	
		(iii)	Measure the distance across n waves with a ruler ✓ Divide distance by n ✓	2	2 × 3.3a	**ALLOW** any value equal to or greater than 2 for n
	(b)		Arrows indicating motion parallel to arrows in diagram ✓ E.g. 	1	1.1	
	(c)	(i)	1000 000 / 10^6 / million ✓	1	2.1	**ALLOW** answers in the order of 10^6 e.g.(3 x 10^8 ÷ 330 =) 9 x 10^5
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 335 (m / s) award 3 marks** (speed =) distance ÷ time ✓ (speed =) 1340 / 4 ✓ (speed =) 335 (m / s) ✓	3	1.2 2 × 2.1	Allow s = d ÷ t
	(d)		Method 1 ✓ **AND** any **one** from: • Distance can be measured accurately for method 1 / ORA ✓ • Difficult to measure distance to lightning strike / lightning occurs in different places ✓ • Times can be repeated and averaged for method 1 / ORA✓	2	3.2a 3.3b	

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 a detailed method **AND** explains how the method works. Suggests a way to produce accurate and precise results. *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 a method **AND either** explains how the method works **OR** suggests a way to produce accurate and precise results. *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 a basic method to determine reaction time **OR** explains how the method works **OR** gives a way to produce accurate or reliable results. *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 × 1.2** **3 x 3.3a** **1 × 3.3b**	**AO1.2: Demonstrate knowledge and understanding of how to measure reaction time:** • Idea that reaction time is how long it takes a person to react to a stimulus / AW • Idea that the mark on the ruler / point where ruler caught estimates reaction time **AO3a: Analyses information to develop a method to determine reaction time:** • 1st person holds the ruler between fingers • 2nd person drops the ruler • 1st person catches it between fingers • Distance from bottom of ruler to fingers measured **AO3b: Analyse information to produce accurate and precise results:** • Students used repeat readings • Students should calculate a mean • Students dropped ruler without any warning • Students varied the time before dropping the ruler • Students made sure ruler was vertical / correct way up each time • Actual results are precise as they are close together / tightly clustered / AW • Student starts with hand at 0 cm

Question			Answer	Marks	AO element	Guidance
15	(a)	(i)	Frequency or energy too high / too dangerous / gamma is ionising radiation / can cause cancer / AW ✓	1	1.2	**ALLOW** wavelength too small / can kill cells
		(ii)	Any **one** from: Microwaves ✓ Visible light ✓ Infra-red ✓ UV ✓	1	1.1	**IGNORE** X-rays / gamma rays / radio waves
		(ii)	Any **one** from: Radar ✓ Satellite (TV) ✓ Mobile phones ✓ Remote controls ✓ Optical fibres / optical wireless communications ✓ Morse code ✓ To see/to read CDs or DVDs ✓ Bluetooth ✓	1	1.1	**IGNORE** any use which does **not** involve communications / just 'TV'
	(b)	(i)	As frequency increases, wavelength decreases / ORA ✓ Any two pairs of values of frequency and wavelength that shows this relationship ✓	2	2x3.1a	Possible pairs: f (MHz) λ(m) 562 0.533 571 0.526 578 0.519 586 0.511 594 0.505 691 0.435
		(ii)	Three / 3 ✓	1	1.2	

	(b)	(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 299 970 000 (m / s) award 3 marks** 594 MHz = 594 000 000 Hz ✓ (Speed =) 594 000 000 × 0.505 ✓ (Speed =) 299 970 000 (m / s) ✓	**3** 	 **1.2** **2.1** **2.1**	**ALLOW** 300 000 000 or 3×10^8 (m / s) with workings shown ✓✓✓ **ALLOW** 2.9997×10^8 (m / s) ✓✓✓ **ALLOW** 299.97 (unit not changed) ✓✓
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.4 award 3 marks** (efficiency =) useful E output ÷ input E ✓ (efficiency =) 100 ÷ 250 ✓ (efficiency =) 0.4 ✓	**3** 	 **1.2** **2.1** **2.1**	 **ALLOW** 40% ✓✓✓ **ALLOW** 0.4% or 0.4 with units or 40 ✓✓

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