

Foundation

GCSE

Combined Science B Twenty First Century Science

J260/03: Physics (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2023

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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.

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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:
- where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
 - 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 is **12**

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)		Ring around filament lamp:  ✓	1	1.1	
	(b)		crocodile clips ✓ complete ✓ electricity ✓	3	1.1	
	(c)		Energy transferred = potential difference × charge ✓	1	1.1	Tick in 3 rd box
	(d)		First check the answer on the answer line If answer = 15 (C) award 2 marks Charge = 0.5×30 ✓ = 15 (C) ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
2	(a)		6 hours ✓	1	3.2b	
	(b)		(C) E B ✓ A D ✓	2	2.1	ALLOW 1 mark for B before A if no other mark
	(c)	(i)	Can cause cell damage/ cell death / mutation / cancer / tumour / destroy cells ✓	1	1.1	IGNORE death / kill / radiation poisoning of whole organism
		(ii)	A radioactive isotope gets on the skin ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
3	(a)		First check the answer on the answer line If answer = 150 (m/s²) award 2 marks acceleration = $0.9 \div 0.006$ ✓ = 150 (m/s ²) ✓	2	2.1	
	(b)	(i)	mass hanger ✓ Card ✓ 100 g mass ✓	3	2.2	
		(ii)	Speed of the trolley when it passes light gate A Speed of the trolley when it passes light gate B Time to travel from light gate A to light gate B ✓✓	2	2.2	3 correct = 2 marks 1 or 2 correct = 1 mark
		(iii)	First check the answer on the answer line If answer = 4 (N) award 2 marks Weight = 0.4×10 ✓ = 4 (N) ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	First check the answer on the answer line If answer = 3 (V) award 2 marks $0.3 \times 10 \checkmark$ $= 3 \text{ (V)} \checkmark$	2	2.1	
		(ii)	First check the answer on the answer line If answer = 0.9 (W) award 3 marks power = current ² × resistance $\checkmark$ $= 0.3^2 \times 10 \checkmark$ $= 0.9 \text{ (W)} \checkmark$	3	1.2 2.1 x 2	ALLOW use of power = current × p.d. $= 0.3 \times 3 = 0.9 \text{ (W)}$ ALLOW use of power = p.d. ² ÷ R $= 3^2 \div 10 = 0.9 \text{ (W)}$ ALLOW ECF value of p.d. from (a)(i)
	(b)	(i)	(Series circuit:) Decreases stays the same $\checkmark$	1	1.1	
		(ii)	(Parallel circuit:) increases $\checkmark$ stays the same $\checkmark$	2	1.1	

Question			Answer	Marks	AO element	Guidance
5	(a)		<p>The spring becomes (plastic) (permanently) deformed OR won't go back to original length/shape (when force is removed) ✓</p> <p>The spring becomes (elastic) OR will go back to original length (when force is removed) ✓</p>	2	1.1	
	(b)		<p>First check the answer on the answer line If answer = 3.6 (cm) award 2 marks</p> <p>Extension = $9 \div 2.5$ ✓ = 3.6 (cm) ✓</p>	2	2.1	

Question			Answer	Marks	AO element	Guidance
6	(a)		fan heater and tv both used for same time, ✓ which shows greater power rating greater energy stored ✓ laptop and fridge have same power rating but fridge used for longer time ✓ which shows longer time appliance is used for, greater change in stored energy ✓	4	3.1b	ALLOW 1 mark for idea of power x time = energy
	(b)		Improve/increase the (thermal) insulation OR An example of improvement/increase in thermal insulation, e.g. double glazing, loft insulation, closing windows etc ✓	1	1.1	IGNORE references to turning off/down appliances / smart meter

Question			Answer	Marks	AO element	Guidance
7	(a)		B ✓	1	2.1	
	(b)		Moving or vibrating more/faster ✓ (Moving faster means) more <u>kinetic</u> energy ✓	2	1.1	IGNORE reference to distance between atoms / changing state
	(c)		First check the answer on the answer line If answer = 114800 (J) award 4 marks Conversion mass = 400 (g) = 0.4 (kg) ✓ Change in temperature = (90 – 20) = 70 (°C) ✓ Energy = mass × SHC × change in temperature = 0.4 × 4100 × 70 ✓ Energy = 114800 (J) ✓	4	1.2 2.1 x 3	ALLOW 1 mark for 70 used ALLOW 1 mark for 0.4 used ALLOW correct answer to 2 or 3sf ALLOW 3 marks for an incorrect conversion or an incorrect temperature change e.g. 147600 (J) 32800 (J) 114800000 (J) conversion missed or a temperature instead of temperature change used. ALLOW 2 marks for incorrect temperature change and incorrect conversion e.g. 147600000 or 32800000 -conversion missed and temperature used instead of temperature change.

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	Car pulling trailer AND trailer pulling on car ✓	1	2.1	ALLOW a single circle around both answers
		(ii)	Any two from: Equal sizes ✓ opposite directions ✓ acting on different objects ✓	2	1.1	ALLOW 'equal and opposite' for 2 marks
	(b)		First check the answer on the answer line If answer = 100800 (J) award 2 marks $0.5 \times 1400 \times 12^2$ ✓ $= 100800 \text{ (J)}$ ✓	2	2.1	ALLOW 1 mark for incorrect mass used e.g. 79200 (J) and 21600(J)

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	Amplitude correctly labelled with A ✓ Wavelength correctly labelled with W ✓	2	1.2	
		(ii)	The number of waves passing a point in one second ✓	1	1.1	Tick in 2nd box
		(iii)	First check the answer on the answer line If answer = 0.3 (m/s) award 3 marks Conversion $0.3 \text{ cm} = 0.003 \text{ m}$ ✓ Wave speed = 100×0.003 ✓ = 0.3 (m/s) ✓	3	1.2 2.1 x 2	ALLOW 2 marks for no unit conversion e.g. 30 (m/s)
	(b)	(i)	speed ✓ ruler ✓ distance ✓	3	1.2	
		(ii)	Take a picture/photo/video / use a camera OR use a strobe ✓	1	1.2	
		(iii)	Measure ten waves (and divide by ten) ✓	1	3.3b	ALLOW any multiple number of waves DO NOT ALLOW repeat and take a mean value
		(iv)	Repeat the experiment 3 times and use the mean value. ✓	1	3.3b	Tick in 2 nd box
		(v)	Replace the vibrating bar with a dipper/ball/ pin ✓	1	3.3b	ALLOW an automatic waterdropper

Question			Answer	Marks	AO element	Guidance
10	(a)		Range 0.5(m/s) to 2.5 (m/s) inclusive ✓	1	1.1	
	(b)		Any one from: Speed is a scalar and velocity is a vector ✓ Speed has no direction OR has magnitude/size only ✓ Velocity has direction (and magnitude/size) ✓	1	1.1	
	(c)	(i)	(4.0, 300) and (5.0, 350) correctly plotted (± 1 small square) ✓	1	2.2	
		(ii)	dot-to-dot D-E and E-F ✓	1	2.2	
		(iii)	First check the answer on the answer line If answer = 75 (km/h) award 2 marks (slope of BC=) $150 \div 2$ ✓ =75 (km/h) ✓	2	2.2	
		(iv)	Any two from: From A-B: Highest constant speed /biggest gradient ✓ From B-C: Slows down but continues at constant speed ✓ From C-D: Stationary/not moving ✓	2	3.1a	DO NOT ALLOW constant speed for stationary
	(d)		First check the answer on the answer line If answer = 7800 (m) award 3 marks (final speed) ² – (initial speed) ² = 2 × acceleration × distance: $56^2 = 2 \times 0.2 \times \text{distance}$ ✓ Distance = 7840 (m) ✓ Distance = 7800 (m) ✓	3	2.1 x 2 1.2	ALLOW any answer to 2 sig figs
	(e)		Any two from: Passengers will decelerate too OR come to a sudden stop OR collide with parts of train ✓ Large acceleration / rapid change of momentum requires large force ✓ (As shown by equation because) mass is constant ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
11	(a)		All electromagnetic radiation travels through space at the same speed. ✓ Our eyes can only detect a limited range of electromagnetic frequencies. ✓	2	1.1	Ticks in 2 nd and 4 th boxes ALLOW any unambiguous indication Mark independently. If 3 or more ticks treat each additional tick as a contradiction of one correct tick.
	(b)	(i)	From left to right: Radio, Microwave, (Infrared), Visible, Ultraviolet, X rays, Gamma rays Radio before Microwave Microwave before Infrared Infrared before Visible Visible before Ultraviolet Ultraviolet before X-ray X-ray before gamma ✓✓✓	3	1.1	Before means anywhere to the left All 6 correct = 3 marks 4 or 5 correct = 2 marks 2 or 3 correct = 1 mark
		(ii)	increases ✓ increases ✓	2	1.1	
	(c)	(i)	Any one from: Develop new theories ✓ Evidence for theories (e.g. big bang) ✓ Improve understanding ✓ Increase knowledge ✓ Generate interest in cosmology/astronomy ✓ (Astronomers can) take measurements from them ✓	1	2.1	DO NOT ALLOW reference to planets, the Sun, the Earth, asteroids, meteors, comets, aliens or life on other planets, the idea we might travel there. ALLOW refs to stars for galaxies. IGNORE reference to imaging galaxies
		(ii)	Any one from: Informed decisions can be made about risks / benefits / costs / ethical issues ✓ Generate interest in cosmology/astronomy ✓ Discoveries can be peer reviewed/checked ✓ Idea of wider / (global) collaboration ✓	1	2.1	IGNORE making people aware / sharing discoveries

Question			Answer	Marks	AO element	Guidance
12	(a)		<p>Renewable: Solar / hydroelectric / tidal / biofuel / wave / geothermal ✓</p> <p>Non-renewable: fossil fuels / coal / oil / (natural) gas ✓</p>	2	1.1	<p>IGNORE wind</p> <p>IGNORE Nuclear ALLOW petrol / diesel / named hydrocarbon</p>
	(b)*		<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) A description of how nuclear fuel and wind are used to generate electricity AND Analysis of the chart to include a comparison, which maybe use of nuclear fuel in 2016 with use in 2020 OR, use of wind in 2016 with use in 2020 OR use of wind with use of nuclear fuel in a particular year OR comparison of rate of change. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) A partial description of how electricity is generated from wind or nuclear fuel AND A partial analysis of the chart. For example, a statement about how the use of nuclear fuel and wind has changed, or a simple comparison of how the use of one has changed between two years.</p>	6	4 x 1.1 2 x 3.1a	<p>AO1.1 Demonstrate knowledge and understanding of scientific ideas. How nuclear fuel is used as an energy resource to generate electricity:</p> <ul style="list-style-type: none"> • Uranium (-235) fuel • Nuclear fission releases energy • Steam turns turbines • Turbines turn generators • Extra detail: e.g. reference to control rods / coolant / moderator / detail on fission process / detail on the generator <p>How wind is used as an energy resource to generate electricity:</p> <ul style="list-style-type: none"> • Use of (wind) turbines • Wind turns blades of wind turbines • Turbines turn generators • Extra detail: e.g. detail on the generator

Question			Answer	Marks	AO element	Guidance
			<p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) A partial description of how electricity is generated from wind or nuclear fuel OR A partial analysis of the chart. For example, a statement about how the use of nuclear fuel and wind has changed, or a simple comparison of how the use of one has changed between two years. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>			<p>AO3.1a Analyse information and ideas to interpret. How use of nuclear fuel has changed 2016-20:</p> <ul style="list-style-type: none"> Decreased Ref. to data e.g. From ~180 000 GWh to ~125 000 GWh (allow $\pm$ 5000 GWh) <p>How use of wind has changed 2016-20:</p> <ul style="list-style-type: none"> Increased Ref. to data e.g. From ~50 000 GWh to ~90 000 GWh (allow $\pm$ 5000 GWh) <p>How relative use of fuel has changed</p> <ul style="list-style-type: none"> More energy from nuclear fuel used than from wind. Was much more (e.g. over 3 $\times$ as much) in 2016, but in 2020 not much more.
	(c)		<p>Any two from: Negative effects on animal habitats ✓ Too little wind / too much wind / rough weather ✓ People may not like look of them ✓ Land could be used for housing / offices instead ✓ They can cause noise pollution ✓ Idea of proximity to populated areas ✓</p>	2	3.2a	<p>ALLOW any reference to amount of wind</p> <p>IGNORE not enough space</p>

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