F

GCSE (9–1)

Combined Science (Physics) A

(Gateway Science)

J250/06: Paper 6 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2019

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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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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

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
I	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

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

Question			Answer	Marks	AO element	Guidance
11	(a)		Radio (waves) **AND** UV / ultraviolet ✓	1	1.1	**BOTH** needed in the correct order
	(b)		**Any one from:** Sound is longitudinal / sound is not transverse / AW ✓ Sound cannot travel through a vacuum ORA ✓	1	2.1	**ALLOW** It is not an electromagnetic wave/ radiation
	(c)	(i)	Gamma (rays) ✓	1	1.1	
		(ii)	Decreases ✓	1	1.1	
	(d)		Damages cells/damages DNA / cause mutations/cause cancer /ionises cells AW ✓	1	1.1	**ALLOW** damage to named tissue/organ **ALLOW** body tissue for cells

Question			Answer	Marks	AO element	Guidance
12	(a)		Protractor ✓ (Metre) ruler / tape measure ✓	2	2 × 3.3a	IGNORE metre stick
	(b)		**Any two from:** take repeat readings ✓ ensure car starts from same point each time / AW ✓ ensure car travels in straight line / AW ✓ use same car each time / same mass / AW keeping surface the same/AW✓	2	2 × 3.3b	**DO NOT ALLOW** take averages **ALLOW** release in same manner **IGNORE** use same angle
	(c)	(i)	Both points correctly plotted to within ± 1 square ✓ Curve of best fit drawn ✓	2	2 × 2.2	**DO NOT ALLOW** straight lines/multiple line/breaks in line
		(ii)	As angle increases, stopping distance increases ✓ Line becomes more curved/ gradient decreases / increase rapid at first / increase slows at higher angles / AW ✓	2	2 × 3.1a	**ALLOW** positive correlation
		(iii)	35 / 36 / 37(cm) ✓	1	2.2	**ALLOW** any reasonable value taken from an interpolation of the candidate's line.
		(iv)	Largest range of distances / biggest difference between the 2 distances / AW ✓	1	3.1b	**ALLOW** 'values not very close compared to others'
	(d)		Thermal✓ Kinetic ✓	2	2 × 2.1	DO NOT ALLOW Heat Answers must be in the correct order

Question			Answer	Marks	AO element	Guidance
13	(a)		Unstable nucleus ✓	1	1.1	**DO NOT ALLOW** unstable isotopes **ALLOW** too many /few neutrons
	(b)	(i)	$^{32}_{15}P \rightarrow {}^{32}_{16}S + {}^{0}_{-1}\beta$ Atomic/proton number of S: 16 ✓ Mass/nucleon number of ß: 0 ✓	2	2 × 2.1	
		(ii)	Use a Geiger counter / G-M tube as detector ✓ **AND** **Any three from:** place paper in front of source ✓ no significant drop in count rate/ particles passing through ✓ place (thin) aluminium in front of source ✓ drop in count rate/particles do not pass through ✓ reading should drop to background / no further drop with lead ✓	4	4 x 2.2	**ALLOW** marks from diagram **ALLOW** thin metal or any suitable material **DO NOT ALLOW** lead
	(c)		Neutrons / alpha particles / helium nuclei ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
	(d)	(i)	**Any two from:** today contains (electron) shells / orbits / ORA ✓ today contains a nucleus / ORA ✓ today nucleus contains protons and neutrons ✓ in 1902 used plum pudding model ✓ in 1902 positive mass containing electrons spread through it / AW ✓ in 1902 there is a cloud of positive charge ✓	**2**	**2 × 1.1**	**ALLOW** positive charge in nucleus **For TWO marks** Today has electrons orbiting a nucleus✓✓
		(ii)	Technology has advanced / new experimental evidence available / new explanations available /more research taking place/ AW ✓	**1**	**1.1**	e.g. new/better equipment available

Question			Answer	Marks	AO element	Guidance
14	(a)	(i)	from batteries from mains/ a.c /230V supply/power station ✓	1	1.1	**BOTH** required **ALLOW** named type of power station e.g. wind turbine
		(ii)	**Any one from:** Thermal / heat (in wires or motor) ✓ Sound (from movement of blades or motor) ✓	1	2.1	**ALLOW** friction/air resistance due movement of blades
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 69 (W) award 2 marks** P = 230 × 0.3 ✓ d = 69 (W) ✓	2	2 × 2.1	

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)** Detailed explanation about why both the tumble dryer and electric drill are safe to use. **AND** Includes the functions of the earth, live and neutral wires. *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)** Explanation about why both the tumble dryer and electric drill are safe to use. **OR** Detailed explanation about why **either** the tumble dryer **or** electric drill are safe to use. **AND** Includes the functions of 2 of the wires. *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)** Explanation about why **either** the tumble dryer **or** electric drill are safe to use. **OR** Includes the functions of 2 of the wires. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.*	**6**	**3 × 1.1** **3 × 3.2b**	**AO3.2b - Analyses the diagrams to draw conclusions about earthing and safety** • tumble dryer has a metal case which is earthed • earth wire prevents an electric shock • if live touches the case, current goes to earth • large current flows to earth rcd/fuse isolates appliance • electric drill has a plastic case • Plastic is an insulator • electric drill is double insulated • if live wire touches case, no chance of a shock • person does not get a shock in both **AO1.1 Demonstrates knowledge and understanding of the functions of the wires** • live wire brings current into appliance • live is at 230 V • live contains switch/fuse for safety • neutral wire completes circuit • neutral is at 0 V • Tumble dryer safe because earth is a safety wire • Earth wire carries current if there is a fault • metal cases require an earth wire • Earth wire carries current to earth if case live

Question			Answer	Marks	AO element	Guidance
			0 marks *No response or no response worthy of credit.*			

Question			Answer	Marks	AO element	Guidance
15	(a)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.2 (ms) award 1 mark** t = 0.2 × 6 = 1.2 (ms) ✓	1	2.2	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 90 000 (m) award 2 marks** d = (3 × 10^8 ×) 0.0003 ✓ d = 90 000 (m) ✓ **OR** d = (3 × 10^8 × 0.0006 =) 180 000 (÷ 2) ✓ d = (180000 ÷ 2) = 90 000 (m) ✓	2	2 × 2.1	
		(iii)	<u>energy</u> lost (to the surroundings/air) / AW ✓	1	3.2b	**ALLOW** energy is dissipated / not all energy reflects / some energy is absorbed
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.5 (m) award 4 marks** Recall and rearrange to give: λ = v ÷ f ✓ (Conversion 200(MHz) =) 2 × 10^8 (Hz) ✓ (λ =) 3 × 10^8 ÷ 2 × 10^8 ✓ (λ =) 1.5 (m) ✓	4	 1.1 1.2 2 × 2.1	 **ALLOW** correct formula in words **ALLOW** λ = 3 × 10^8 ÷ 2 x 10^n for two marks **ALLOW** 1.5 x 10^n for correct calculation but incorrect conversion of MHz to Hz for 3 marks

Question			Answer	Marks	AO element	Guidance
16	(a)		Mean is all the numbers added together and then divided by the total number ✓ Mode is the number which occurs most often **AND** 14 ✓ Median is the middle number **AND** 14 ✓	3	3 × 1.2	**ALLOW** Mean is the average **AND** 14.3 / 14 **ALLOW** the number that occurs twice/most frequent/most popular / AW **AND** 14 **ALLOW** method to find the median **AND** 14 if no other marks awarded **ALLOW** correct values for mode **AND** median for one mark
	(b)		Half-life = 4 (throws) ✓	1	2.1	**IGNORE** decimal answers that round to 4

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