

GCSE (9-1)

Physics A (Gateway)

Unit **J249F/02**: Foundation Tier – Paper 2

General Certificate of Secondary Education

Mark Scheme for June 2018

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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
/	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 Biology/Chemistry/Physics/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			D ✓	1	1.1	
2			B ✓	1	1.1	
3			D ✓	1	1.1	
4			B ✓	1	1.1	
5			C ✓	1	2.2	
6			C ✓	1	2.2	
7			D ✓	1	2.2	
8			C ✓	1	2.1	
9			B ✓	1	2.1	
10			C ✓	1	1.2	
11			B ✓	1	2.2	
12			A ✓	1	2.2	
13			C ✓	1	2.2	
14			D ✓	1	2.1	
15			C ✓	1	2.2	

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
16	a	i	3.5 (cm) ✓	1	1.1	ALLOW 3.4 to 3.6
		ii	2.4 (cm) ✓	1	1.1	
		iii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.5 (m/s) award 2 marks 2 x 25 OR 2 x 0.25 ✓ 0.5 (m/s) ✓	2	2 x 2.1	ALLOW 50
	b	i	(Particles move) up and down / oscillate/vibrate vertically/at right angles to the direction of the wave ✓	1	1.1	
		ii	(Particles move) forwards and backwards / oscillate/vibrate parallel to the direction of the wave / AW ✓	1	1.1	
	c	i	Radio / infra-red / microwave ✓	1	1.1	
		ii	Ultra-violet / X-rays / gamma-rays ✓	1	1.1	
		iii	Any two from: Radiotherapy / killing cancer cells ✓ Irradiating food / sterilisation of instruments ✓ Tracer / medical imaging ✓ Scanning metals / non-destructive testing (NDT) ✓	2	2 x 1.1	ALLOW tumours / treatment of cancer ALLOW killing bacteria / (harmful) microorganisms / sterilising food

Question			Answer	Marks	AO element	Guidance
17	a		Any two from: Keeping a safe distance (from source) ✓ Use tongs ✓ Point sources away from people ✓ Keep sources in sealed containers ✓ Keep exposure time as short as possible ✓	2	2 x 1.2	ALLOW behind (lead) screen IGNORE gloves/goggles ALLOW lead box
	b	i	(Source) A ✓ (Source) A because (idea that) count rate unaffected by paper and aluminium OR only lead reduces / stops gamma ✓	2	3.2a 2.1	ALLOW cannot travel through lead
		ii	(Source) B ✓ (Source) B because count rate is reduced by paper ✓	2	3.2a 2.1	
		iii	(Source) D ✓ (Source) D because (idea that) count rate decreases after aluminium (beta) <u>and</u> after lead (gamma) ✓	2	3.2a 2.1	ALLOW not absorbed by paper
	c		Any two from: Radioactive decay is random ✓ Variations are more pronounced at low count rates ✓ Background radiation ✓	2	2 x 3.1a	

Question			Answer	Marks	AO element	Guidance
	d		Any two from: Larger number of counts ✓ Less variation in count rate ✓ Gives an average count rate ✓ Gives more repeatable results ✓ Makes it easier to decide what the source is ✓	2	2 x 3.3b	ALLOW more radiation detected ALLOW idea of smoothing out variations ALLOW more reliable IGNORE accurate

Question			Answer	Marks	AO element	Guidance
18	a	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 60 000 (J) award 2 marks 48 000 + 12 000 ✓ = 60 000 (J) ✓	2	2.2 2.2	Check table
		ii	C ✓	1	3.2b	
		iii	B ✓	1	3.2b	
		iv	Heat / sound / KE of particles passed to other particles / AW ✓	1	1.1	ALLOW (energy) transferred to surroundings / by friction
		v	Lubrication / oil ✓	1	2.1	ALLOW reduce friction
	b		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 89 (%) award 3 marks 48 000 ÷ 54 000 (x 100) ✓ = 88.88888....etc ✓ = 89(%) (2 sig figs) ✓	3	2.1 2.1 1.2	ALLOW two marks for 0.89 or 88(%) ALLOW one mark for 0.88

Question			Answer	Marks	AO element	Guidance
19	a		Distance (between source and observer) ✓ Time (for sound to travel between source and observer) ✓	2	2 x 1.1	Do not accept distance / time the ball travels Do not accept metres / seconds
	b		Speed = distance ÷ time ✓	1	1.1	ALLOW distance ÷ time
	c		Takes several readings / take averages / increase distance ✓	1	3.3a	ALLOW no wind IGNORE increase time

Question			Answer	Marks	AO element	Guidance
20	a		Thinking distance doubles ✓	1	1.1	ALLOW higher level answer: thinking distance is (directly) proportional to speed
	b		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.75 (s) award 3 marks Recall: (Reaction) time = (Thinking) distance ÷ Speed ✓ 6÷8 or 12÷16 or 24÷32 ✓ = 0.75 (s) ✓	3	1.2 2.1 2.1	IGNORE correct substitutions if NOT rearranged

Question		Answer	Marks	AO element	Guidance
	c*	<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) Explains quantitatively why the stopping distances are different for each speed in the table in terms of braking distance and thinking distance. <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) Explains qualitatively why the stopping distances are different for each speed in the table in terms of braking distance or thinking distance increasing with speed from the table <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) States basic ideas about thinking distance / braking distance / stopping distance OR identifies variation of thinking distance / braking distance / stopping distance with speed <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 - No response or no response worthy of credit.</p>	6	2 x 1.1 2 x 2.1 2 x 3.2b	<p>AO1.1a Demonstrates knowledge and understanding of thinking, braking and stopping distance</p> <ul style="list-style-type: none"> Thinking distance is the distance the car travels while the driver reacts Braking distance is the distance travelled while the brakes are applied Stopping distance is thinking distance + braking distance <p>AO2.1 Applies knowledge and understanding of thinking, braking and stopping distance in relation to the details in the table</p> <ul style="list-style-type: none"> Increasing the speed, increases the thinking distance Increasing the speed, increases the braking distance Increasing the speed, increases the stopping distance <p>AO3.2b Analyses information to make judgements and draw detailed conclusions from table</p> <ul style="list-style-type: none"> Thinking distance is directly proportional to the speed When speed doubles, thinking distance doubles Braking distance is proportional to speed² When speed doubles, braking distance quadruples

Question			Answer	Marks	AO element	Guidance
21	a		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 120 (N/cm²) award 3 marks Recall: pressure = force ÷ area ✓ 12000 ÷ 100 OR 40000 ÷ 25 ✓ = 120 (N/cm ²)	3	1.2 2.1 2.1	ALLOW 12000÷25 for one mark ALLOW for two marks 480 (N/cm ²)
	b	i	Reduces <u>pressure</u> / spreads the <u>force</u> / AW ✓	1	1.1	
		ii	Absorb energy (in a crash) ✓	1	1.1	ALLOW higher level answers: eg. Reduces force / acceleration E.g. Increases time / distance to stop
	c		Mass / inertia of child is lower ✓ Less force is needed (for the same deceleration)✓	2	2.1 1.1	ALLOW weight of child is lower/child is smaller

Question			Answer	Marks	AO element	Guidance
22	(a)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 12 (m/s) award 2 marks Rearrange formula - 4×3 ✓ 12 (m/s) ✓	2	 2.1 2.1	
	(b)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 800 (kg) award 3 marks Recall: force = mass x acceleration ✓ $4000 \div 5$ ✓ 800 (kg) ✓	3	 1.2 2.1 2.1	 ALLOW 0.8 for two marks

Question			Answer see separate sheet	Marks	AO element	Guidance
23	a	i	5.2 (billion tonnes oil equivalent) ✓	1	3.1a	ALLOW answers between 5.0 and 5.5 IGNORE wrong units
		ii	Oil ✓	1	3.1a	
		iii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 78 (%) award 2 marks 8.3 / 10.6 (x 100) ✓ =78 (%) ✓	2	2 x 3.1a	ALLOW answers that round between 77(%) and 80(%) ✓✓ ALLOW 8.2 / 10.6 (x 100) OR 8.4 / 10.6 (x 100) OR 8.5 / 10.6 (x 100) OR answers that round between 0.77 and 0.80
	b	i	Fossil fuel may run out / is non-renewable / be in short supply / become very costly ✓ Named damage to environment: Eg (increased) greenhouse gases / global warming / sea levels rise / carbon dioxide / climate change / acid rain ✓	2	3.1b 3.1b	ALLOW being used faster than being produced / finite resource ALLOW ice caps melting / droughts and storms / more polluting gases / other named polluting gases e.g. SO ₂ / carbon emissions IGNORE just pollution or bad for the environment / more CFCs
		ii	To meet demand for electricity / not enough energy from renewable resources ✓ Less named damage to environment: (decreased) greenhouse gases / global warming / sea levels may fall / carbon dioxide / climate change / acid rain / ORA for coal ✓	2	1.2 1.2	ALLOW will not run out as fast (as coal) / to preserve fossil fuels / produces more energy (per kg than coal) ALLOW less polluting gases / carbon emissions / ice caps melting / droughts and storms IGNORE just less pollution or just better for the environment / less CFCs

Question			Answer see separate sheet	Marks	AO element	Guidance
	c	i	Step-up transformer ✓	1	1.1	
		ii	Reduce energy wastage / loss ✓	1	1.1	ALLOW less heat loss / reduce current / reduce power loss / more useful power out / more efficient / less heating of wires DO NOT ALLOW no energy losses / prevent energy loss / AW
		iii	d.c – (current / voltage / charge flow / it) has one direction or polarity ✓ a.c.- (current / voltage / charge flow / it) (continually) changes direction or polarity ✓	2	1.1 1.1	ALLOW dc only positive / only negative IGNORE electricity ALLOW current / voltage alternates OR positive and negative
	d	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 2.8 (kW) award 4 marks (P =) $I^2 \times R$ ✓ 11 x 11 x 23 or $11^2 \times 23$ or 121 x 23 ✓ = 2783 ✓ Conversion to kW = 2.8 (kW) ✓	4	 1.2 2.1 2.1 2.1	ALLOW 2.78 kW or 2.783 kW ✓✓✓✓ ALLOW equation in any form ALLOW ecf candidates answer to 3 rd marking point converted to kW
		ii	Wind speed varies / AW ✓	1	2.1	ALLOW it depends on the strength of the wind / how windy it is / AW IGNORE there might not be any wind / wind changes direction / AW
		iii	(Idea of) not always enough wind / demand may exceed supply / AW ✓	1	2.1	ALLOW (it) may not generate enough power / energy / AW

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

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