OCR
Oxford Cambridge and RSA

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.

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

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) and 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:**	**2**	2 x 3.3b	
			Larger number of counts ✓			**ALLOW** more radiation detected
			Less variation in count rate ✓			**ALLOW** idea of smoothing out variations
			Gives an average count rate ✓			
			Gives more repeatable results ✓			**ALLOW** more reliable
			Makes it easier to decide what the source is ✓			**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*		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)** **Explains quantitatively why the stopping distances are different for each speed in the table in terms of braking distance and thinking distance.** *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)** **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** *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)** **States basic ideas about thinking distance / braking distance / stopping distance OR identifies variation of thinking distance / braking distance / stopping distance with speed** *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 x 1.1 2 x 2.1 2 x 3.2b	**AO1.1a Demonstrates knowledge and understanding of thinking, braking and stopping distance** • 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 **AO2.1 Applies knowledge and understanding of thinking, braking and stopping distance in relation to the details in the table** • Increasing the speed, increases the thinking distance • Increasing the speed, increases the braking distance • Increasing the speed, increases the stopping distance **AO3.2b Analyses information to make judgements and draw detailed conclusions from table** • Thinking distance is directly proportional to the speed • When speed doubles, thinking distance doubles • Braking distance is proportional to speed^2 • 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/cm^2) award 3 marks**	**3**		
			Recall: pressure = force ÷ area ✓		1.2	
			12000 ÷ 100 OR 40000÷ 25 ✓		2.1	**ALLOW** 12000÷25 for one mark
			= 120 (N/cm^2)		2.1	**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 ✓	**2**	2.1	**ALLOW** weight of child is lower/child is smaller
			Less force is needed (for the same deceleration)✓		1.1	

Question			Answer	Marks	AO element	Guidance
22	(a)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 12 (m/s) award 2 marks**	**2**		
			Rearrange formula - 4 x 3 ✓		**2.1**	
			12 (m/s) ✓		**2.1**	
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 800 (kg) award 3 marks**	**3**		
			Recall: force = mass x acceleration ✓		**1.2**	
			4000 ÷ 5 ✓		**2.1**	
			800 (kg) ✓		**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 x R ✓ 11 x 11 x 23 or 11^2 x 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 3rd 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

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