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H

GCSE (9–1)

Combined Science A (Physics) A (Gateway Science)

J250/11: Paper 11 (Higher 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
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

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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

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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.

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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.

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

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Question			Answer	Marks	AO element	Guidance
11	(a)		Connect one terminal of cell/battery to **A** / AW ✓ **BUT** Lamp only lights if **A** is connected to positive (terminal) ✓✓ Connect other terminal of cell/battery to **B** / AW ✓	3	3×3.3a	 **IGNORE** lamps does not light if **B** is connected to positive (terminal) **ALLOW** idea of putting cell/battery between **A** and **B** in words or drawn on the diagram ✓✓ **ALLOW** add a cell/battery (to the series circuit) if no other mark awarded
	(b)	(i)	**Any two from:** **Not** a straight line ✓ (not a straight line) through 0 ✓ No current in reverse direction/reverse bias/when p.d. is negative / AW ✓ no current until p.d. reaches threshold/0.5 (V) ✓	2	2×1.1	p.d. and voltage are interchangeable throughout this question but ignore references to resistance **ALLOW** gradient changes / gradient not constant **ALLOW** graph does **not** obey Ohm's Law **ALLOW** the graph is a curve **ALLOW** (p.d and current) **not** proportional **BUT** (p.d and current) **not** directly proportional ✓✓ **ALLOW** the current only flows in one/positive direction **ALLOW** the current increases after 0.5 (V) **IGNORE** just 'it' begins at 0.5 (V)

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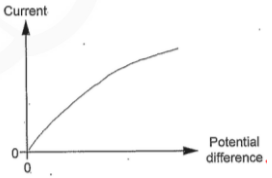
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 40 (Ω) award 4 marks** (R =) p.d ÷ Current ✓ From graph, (I =) 0.02 (A) ✓ 0.8 / 0.02 ✓ = 40 (Ω) ✓	**4** **1.2** **2.2** **2.1** **2.1**		**ALLOW** 0.8 ÷ current **ALLOW** answer from graph in region 0.017 (A) to 0.023 (A) **ALLOW** ecf from candidate's reading for current from graph If reading of current from 0.017 (A) to 0.023 (A) then allow answer from 34.78 (Ω) to 47.06 (Ω) for 4 marks e.g. a current of 0.018 gives the answer of 44.4 (Ω)
	(c)		**Any two from:** Current becomes (too) large/increases (too much) ✓ Resistance of diode decreases (rapidly) ✓ Diode can be damaged/blow/break ✓	**2**	**2×3.2b**	 **ALLOW** any answer that implies the current has increased e.g. current would be too high/too much **IGNORE** too strong **ALLOW** the diode can explode / overheat / AW **IGNORE** it would be dangerous / heat up / blows the circuit / damages the circuit / just diode stops / short circuit / breaks the circuit / blows the fuse
	(d)		Graph starting at 0 with positive and decreasing slope ✓	**1**	**1.2**	 **IGNORE** intial straight line / leveling off / any part of the graph outside the axes

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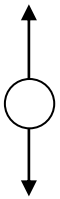
Question			Answer	Marks	AO element	Guidance
12	(a)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 2 (g / cm^3) award 3 marks** Mass of (each) cube is 16 × 1 = 16 (g) ✓ Volume of **B** is 2^3 = 8 (cm^3) ✓ = 2 (g / cm^3) ✓ **OR** Volume of **B** is 8 × volume of **A** ✓ Density of **B** is 1/8 × density of **A** = 16 / (2^3) ✓ = 2 (g / cm^3) ✓	3	 2×2.1 1×2.2 OR 2×2.1 1×2.2	**ALLOW** higher level answers involving $\rho_1V_1 = \rho_2V_2$ **IGNORE** 16 ÷1 = 16 (g) **ALLOW** 2 x 2 x 2 = 8 (cm^3)
		(ii)	Density of cube/metal/**A** > density of water ✓	1	1×1.1	**ALLOW** density of cube/metal/**A** is greater (than 1) / more dense / higher density **IGNORE** it has a greater density than cube **B**
	(b)	(i)	 Force up: pull of support on spring / surface force from support / AW ✓ Force down: pull of cube **A** / AW ✓	2	2×1.2	**ALLOW** higher level answers involving weight of the spring in addition to weight of cube **IGNORE** weight / gravity Pull or force must be present in the answer for the mark to be awarded

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		(ii)	Forces are equal (and opposite) / force up = force down / force of cube = force of support / AW ✓	**1**	**1.1**	**ALLOW** forces are balanced / in equilibrium / forces cancel out **IGNORE** references to Newton's Third Law
		(iii)	The spring accelerates ✓	**1**	**1.1**	**ALLOW** spring moves (in the direction of the force) / falls / position changes **IGNORE** refences to the spring changing shape / spring deforms / stretching or not stretching / unbalanced force / constant velocity
		(iv)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.2 (N) award 3 marks** (F =) kx ✓ F = 30 × 0.04 ✓ = 1.2 (N) ✓	**3**	 **1.2** **2.1** **2.1**	 **ALLOW** correct equation in words or symbols

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Question			Answer	Marks	AO element	Guidance
13	(a)	(i)	Yes **AND** gives a correct stated trend shown by the data to support the conclusion ✓ **OR** No **AND** gives a correct stated trend shown by the data to support the conclusion ✓	1	3.1b	Examples of the trend shown by the data: the 10 turns picks up less than the 50 turns 10 turns attracts 1 pin but 50 attracts 4 pins a stronger magnetic field means more pins attracted as coils increase so does number of pins attracted as the turns increase so do the number of pins **IGNORE** just part of the trend e.g. when there were 50 coils it picked up 4 pins Examples of the trend shown by the data: when turns increase 20 to 40 then 2 pins attract when the current is 0.25 (A) there is no difference between 20 and 30 turns **IGNORE** just part of the trend e.g. when there were 20 coils it picked up 2 pins
		(ii)	Lower current (has less heating effect) / less power required / AW	1	3.2a	**ALLOW** uses less amps **IGNORE** less energy / stronger (magnetic field) / quicker / more reliable
	(b)	(i)	Clockwise **AND** (Fleming's) left hand rule ✓	1	1.2	**BOTH** needed for mark **IGNORE** upwards / downwards / right **IGNORE** other names

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		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.2 × 10^{-3} (N) award 4 marks**	**4**		
			(F =) BIL ✓		**1.2**	**ALLOW** correct equation in words or symbols
			(Length in field = 3 cm =) 0.03 (m) ✓		**1.2**	**DO NOT ALLOW** 0.03 (m) + another length e.g. 0.03 (m) + 0.02 (m)
			F = 0.08 × 0.5 × 0.03 ✓		**2.1**	**ALLOW** (ecf for using cm) 0.08 x 0.5 x 3 ✓✓
			= 1.2 × 10^{-3} (N) ✓		**2.1**	**ALLOW** (ecf for using cm) 0.12 ✓✓✓

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Question			Answer	Marks	AO element	Guidance
14	(a)		Evidence for use of area under line / distance = area under v-t graph / Area ≈ 62 × 20 = 1240 m ✓ **BUT** Total distance = 1240 + 750 = 1990 (m) ✓✓	**2**	**2×1.2**	**ALLOW** area from1200 to 1240 (m) **DO NOT ALLOW** a calculation of 62 x 40 on its own or 2480 on its own **ALLOW** total distance calculated from 1950 to 1990 (m) ✓✓ **DO NOT ALLOW** answer of (approximately) 2000 with no workings
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 50 (m / s) award 3 marks** (speed =) distance travelled / time taken ✓ (s =) 2000 / 40 ✓ = 50 (m / s) ✓	**3**	 **1.2** **2.1** **2.1**	 **ALLOW** the candidate's value of distance from **(a):** If value from **(a)** is 1990 then answer is 49.75 or 49.7 or 49.8 or 50 (m / s) ✓✓✓✓ If value from **(a)** is 1950 then answer is 48.75 or 48.8 (m / s) ✓✓✓✓

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Question			Answer	Marks	AO element	Guidance
15	(a)		multiply mass by acceleration due to gravity / (F =) mg ✓ **BUT** (W =) 0.4 ×10 or 4 (N) ✓✓	2	1.1 1.2	**ALLOW** (F =) ma
	(b)		(s = d/t gives) speed at **X and Y** obtained ✓ **BUT** acceleration = change in velocity or speed ÷ time / (a =) [v – u] ÷ t ✓✓	2	3.3a 1.1	Must be idea of obtaining two velocities or speeds e.g. the final velocity and the intial velocity / minus initial velocity squared from final velocity squared / measure the change in velocity
	(c)		**Any one from:** place surface at an angle /use incline ✓ use an air track/oil ✓ increase the width of **X** and **Y** ✓ accurately weigh masses before use ✓ make sure masses are uniform ✓	1	3.3b	**ALLOW** use smoother surfaces /do it on a frictionless surface / airline (track) **IGNORE** use more light gates / repeat / find a mean

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Question			Answer	Marks	AO element	Guidance
15	(d)	*	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 and explains in detail what the results show and evaluates the validity of the 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 and explains what the results show and comments on the validity of the results. **OR** Describes and explains in detail what the results show. *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)** Basic description or explanation of what the results show. **OR** Comments on the validity of the 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**	**3×2.2** **3×3.2b**	**AO2.2 Applies knowledge and understanding of force and acceleration** • as force increases, acceleration increases / there is a positive correlation • line of best fit shows force is directly proportional to acceleration • doubling the force, doubles the acceleration / AW • linear relationship through 0 **AO3.2b Analyses information and ideas to draw conclusions about the graph** • results suggests not proportional/not linear • line of best fit is poorly drawn / does not go through majority of points • actual line of best fit is **not** through 0 • poor validity as points not close to line of best fit / points are scattered • **not** enough results / **no** evidence of repeated results **IGNORE** general statement e.g. the results are inconsistent / some results are wrong / there is an anomaly

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Question			Answer	Marks	AO element	Guidance
15	(e)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.98 (per kg) award 2 marks** (Gradient =) 5 / 5.1 ✓ = 0.98 (per kg) ✓	2	2×2.1	**ALLOW** correct use of any correct triangle on graph, provided it covers a force greater than 1 (N) and an acceleration greater than 1 (m/s^2) **ALLOW** answer in range of 0.96 to 1 (per kg)
		(ii)	Identifies intercept as - 0.8 ✓ y = 0.98x - 0.8 ✓	2	2×2.1	**ALLOW ECF** from part (i), i.e. y = gradient x their intercept if clear or - 0.8 e.g. If answer to part (i) is 1 then y = x - 0.8 or y = 1x - 0.8 ✓✓ **ALLOW** a = 0.98f -0.8 ✓✓

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