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 November 2020

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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

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 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	B	1	1.1	
2	B	1	1.1	
3	B	1	1.2	
4	D	1	1.2	
5	C	1	2.2	
6	C	1	2.1	
7	D	1	2.1	
8	A	1	2.2	
9	A	1	2.1	
10	A	1	1.1	

Question			Answer	Marks	AO element	Guidance
11	(a)		**Any two from:** Strength of field ✓ Magnitude of force ✓ Direction of field or force ✓ Position of poles ✓	**2**	**2 × 1.1**	**ALLOW** strongest close to magnet/poles / ORA **IGNORE** just north is strongest / just south is strongest **ALLOW** stronger forces where the field lines are closer / ORA **ALLOW** (field or force goes) north to south / (field or force) into south / (field or force) out of north / (field or force) starts from north **ALLOW** north at one end and south at other end / where (the position) of north and south are **IGNORE** references to opposites attract / same poles repel
	(b)		(idea that when tested using a permanent magnet) Permanent magnet as there is repulsion **because** like poles repel ✓ Copper as no attraction (or repulsion) **because** it is not magnetic ✓ Iron as attraction (only) **because** iron is magnetic ✓	**3**	**3 × 3.3a**	If no mark awarded **ALLOW** max 1 mark for correct description without explanations for all three blocks **ALLOW** copper as no attraction (or repulsion) **because** it is not affected by magnets **Ignore** induction / stick (for attract)

	(c)	**(i)**	As distance increases, dip angle decreases / ORA ✓ As the distance increases, dip angle decreases at an increasing rate / ORA✓	**2**	**2 × 3.1a**	**ALLOW** inverse relationship **IGNORE** negative correlation **ALLOW** not linear / not proportional / change is more gradual / slower near pole / ORA **ALLOW** comparison of two data points For 1 mark only **ALLOW** inversely proportional
		(ii)	72 (°) ✓	**1**	**2.2**	**ALLOW** 72 (°) + or - 2
		(iii)	**Any one from:** Not accurate **AND** value not (close enough to) 66° ✓ Accurate **AND** value close to 66° ✓	**1**	**3.2a**	**ALLOW** ecf from cii **ALLOW** description in form of a calculation e.g. 72 – 3 = 69 not 66 **ALLOW** Not accurate **AND** because it is too different/more than 3^{o} different **ALLOW** Accurate **AND only** slightly different/less than 3^{o} different
		(iv)	**Earth's** core is magnetic / the direction of **Earth's** magnetic field / the **Earth** has a magnetic field AW ✓	**1**	**3.2b**	**ALLOW Earth** has a magnetic force / has magnetic poles / **Earth** is magnetic
	(d)		**Any two from:** Both students or both statements are incorrect ✓ (As distance doubles,) field strength halves or is multiplied by 0.5 / ORA ✓ Use of values from graph showing inversely proportional relationship or showing field strength is **not** multiplied by 0.25 or 0.75 ✓	**2**	**2 × 3.1b**	 **ALLOW** inversely proportional **ALLOW** use of any 2 suitable values to show inversely proportional relationship or that field strength is **not** multiplied by 0.25 or 0.75, e.g. (0.01, 4) to (0.02,2) or (0.02,2) to (0.04,1) etc.

Question			Answer	Marks	AO element	Guidance
12			**Any three from:** As temperature increases, speed of particles increases / AW ✓ As temperature increases, (kinetic) energy of particles increases ✓ Particles collide more frequently (with wall of canister) ✓ Particles collide with more force (with wall of canister) ✓ Increased pressure can cause canister to explode ✓	**3**	**3 × 2.1**	**ALLOW** a higher level response: at high temperature, greater rate of change of momentum increasing force ✓✓

Question			Answer	Marks	AO element	Guidance
13	*		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 the properties of **A** and **B** using knowledge of elastic and plastic deformation. **AND** Describes the properties of **A** and **B** using knowledge of linear and non-linear relationships between force and extension. **AND** Describes how the graphs show different stiffness of **A** and **B**. *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 the properties of **A** and **B** using knowledge of elastic and plastic deformation. **AND** Describes the properties of **A** and **B** using knowledge of linear and non-linear relationships between force and extension. **OR** Describes the properties of **A** and **B** using knowledge of elastic and plastic deformation. **AND** Describes how the graphs show different stiffness of **A** and **B**.	**6**	**4 × 1.2** **2 × 3.2b**	**AO3.2b Analyses information and ideas to draw conclusions about properties of each spring** • Gradient of graph for A > gradient of graph for B • Spring constant for A > spring constant for B • As k = F / x • A is stiffer but elastic • B is more flexible but plastic **AO1.2 Demonstrates knowledge of linear and non-linear relationships between force and extension.** • Linear relationship (between F and x) for A / gradient is a straight line • F proportional to x for A • Non-linear relationship for B • A obeys Hooke's law • B obeys Hooke's law for small forces only or to start with / gradient is constant and then changes **AO1.2 Demonstrates knowledge of elastic and plastic deformation** • A shows elastic behaviour / not permanently deformed • A recovers original shape when force removed • B shows plastic behaviour • B shows permanent deformation (when force is removed)

Question			Answer	Marks	AO element	Guidance
			OR Describes the properties of **A** and **B** using knowledge of linear and non-linear relationships between force and extension. **AND** Describes how the graphs show different stiffness of **A** and **B**. *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)** Describes the properties of **A** and **B** using knowledge of elastic and plastic deformation. **OR** Describes the properties of **A** and **B** using knowledge of linear and non-linear relationships between force and extension. **OR** Describes how the graphs show different stiffness of **A** and **B.** *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.*			

Question			Answer	Marks	AO element	Guidance
14	(a)	(i)	Same number of + and – ✓	1	2.1	**ALLOW** positive and negative charges balance out / positive and negative are equal / protons and electrons cancel
		(ii)	**Any three from:** Electrons in hair move to top of hair / (top of) hair is negatively charged ✓ As they are attracted by the + rod ✓ As **opposite/different** charges attract ✓ The − charge is now closer to the + charge rod ✓ The (individual) hairs repel each other as they have like or – charge ✓	3	3 × 2.1	
		(iii)	Metal is a conductor / charges flow to earth ✓	1	1.1	**ALLOW** static charges do not build up on an insulator **NOT** hair is a conductor
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.36 (J) award 4 marks** Conversion of 30 kV to 30 000 V ✓ Recall of E = Q × V ✓ E = 1.2 × 10^{-5} × 30 000 ✓ E = 0.36 (J) ✓	4	 1.2 1.2 2 × 2.1	 **ALLOW** on the answer line 3.6 and any factor (because of the conversion error) for 3 marks e.g. 3.6 x 10^{-4}

Question			Answer	Marks	AO element	Guidance
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.024 (A) award 3 marks** Rearrangement: I = Q / t ✓ I = 1.2 × 10^{-5} ÷ 0.0005 ✓ E = 0.024 (A) ✓	**3**	**1.2** **2 × 2.1**	

Question			Answer	Marks	AO element	Guidance
15	(a)		1st row: Unbalanced forces (on skydiver) / resultant force / AW ✓ 2nd row:  (Air resistance) (Force of Earth on skydiver) ✓ 3rd row: Skydiver reaches terminal/constant velocity or constant speed ✓	3	3 × 1.1	Arrow for air resistance **must** be smaller than arrow for weight. **IGNORE** labels **ALLOW** 'no acceleration' **DO NOT ALLOW** reached the ground / constant acceleration
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 26 (m/s) award 3 marks** Distance = area under the graph / AW ✓ (0.5 × 10 × v) + (10 × v) = 390 **OR** 15v = 390 ✓ v = 26 (m/s) ✓	3	1.2 2 × 2.1	

Question			Answer	Marks	AO element	Guidance
16	(a)		Section X: Uniform speed/velocity ✓ Dots equally spaced ✓ Section Y: Acceleration / increasing speed ✓ Dots getting further apart ✓	4	 1.1 1.2 1.1 1.2	**ALLOW** constant speed/velocity/motion **IGNORE** just motion is increasing / comparisons with X or tapes e.g. faster than X **DO NOT ACCEPT** it changes direction
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.4 (m/s) award 3 marks** Rearrangement: s = d / t ✓ s = 0.028 ÷ 0.02 ✓ s = 1.4 (m / s) ✓	3	 1.2 2 × 2.1	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 3 (m / s^2) award 3 marks** Realises 5 gaps = time between 2 speeds. **OR** Time = 5 × 0.02 = 0.1 s ✓ a = (1.3 – 1.0) ÷ 0.1 ✓ a = 3 (m / s^2) ✓	3	3 × 2.1	**ALLOW** 2 marks for using 6 gaps Time would be 0.12 s giving a = 2.5 (m / s^2). **IGNORE** sign / -
	(c)		Decrease height of ramp / decrease slope of ramp / AW ✓	1	3.3b	**ALLOW** use a longer ramp (at the same height)

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