

# H

**GCSE (9–1)**

**Combined Science B (Twenty First Century Science)**

**J260/08: Combined Science (Higher Tier)**

General Certificate of Secondary Education

**Mark Scheme for Autumn 2021**

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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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## 1. 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

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

<b>Annotation</b>	<b>Meaning</b>
/	alternative and Allowable answers for the same marking point
✓	Separates marking points
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be Allowed
( )	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	Or reverse argument

### 3. 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 B:

	<b>Assessment Objective</b>
<b>AO1</b>	<b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
<b>AO2</b>	<b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
<b>AO3</b>	<b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b>
<b>AO3.1</b>	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
<b>AO3.2</b>	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.
<b>AO3.3</b>	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	(a)	<p><b>Any four from:</b>                      She should use a quadrat ✓                      placed randomly in the garden / use a transect ✓                      Count the number of buttercup plants (in the quadrat) ✓                      Take more samples ✓                      Find the mean number of plants ✓</p>	4	3.3b	<b>IGNORE</b> the idea of counting all the plants	
	(b)	<p>✓✓</p> <p>The diagram consists of three boxes on the left and two on the right. Lines connect 'Shade from trees' to 'Less sunlight is available for photosynthesis'. Lines connect 'Waterlogged soil' to both 'Fewer leaves to absorb light' and 'Less oxygen available for respiration in root cells'. A line connects 'More slugs to eat plants' to 'Less oxygen available for respiration in root cells'.</p>	2	2.1	All 3 correct scores 2 marks 2 or 1 correct scores 1 mark	
	(c)	(i)	260 ✓	1	3.1a	
		(ii)	75 <sup>(th)</sup> ✓	1	3.1a	

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Question		Answer	Marks	AO element	Guidance
2	(a)	Equipment B <b>AND</b> water will evaporate and then condense ✓ Equipment A won't filter sea water as salt is dissolved ✓ Equipment C will boil the water away and just leave salt / crystals ✓	3	3.2a	
	(b)	(i) petrol (top) kerosene diesel (oil) (bottom) ✓✓	2	3.1b	All 3 correct scores 2 marks 2 or 1 correct scores 1 mark  <b>ALLOW</b> alternative wording for petrol e.g gasoline
		(ii) <b>Any one from:</b> fractionating tower is hottest at the bottom and coolest at the top ✓  Naphtha has a lower boiling point (than fuel oil) ✓  <b>AND any one from:</b> Naphtha molecules are smaller/ have fewer C atoms/ shorter C chain (than fuel oil) ✓  Naphtha molecules have weaker intermolecular forces (than fuel oil) ✓  Naphtha molecules condense at a lower temperature (than fuel oil) ✓	2	2.1	Assume 'it' refers to naphtha



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Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	The typical speed for walking <b>1.5 m / s</b> ✓ The typical speed for cycling is <b>7 m/s</b> ✓ The typical speed for a car is <b>90 km / h</b> ✓	3	1.1	
		(ii)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 6.700... m/s award 4 marks</b>  Speed = distance ÷ time ✓ Conversion of 20km to 20 000m ✓ Conversion of 49mins 45 seconds to 2985 seconds ✓ (20 000 ÷ 2985) = 6.700... ✓	4	1.2 x 3  2.1	
		(iii)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 720 kg m/s award 2 marks</b>  Momentum = mass x velocity ✓  60 x 12 = 720 kg m/s ✓	2	1.2  2.1	
	(b)		<b>EITHER</b> increases ✓ duration ✓ force ✓ <b>OR</b> Decreases ✓ force ✓ force ✓	3	2.1	Only award marks from one combination of marking points
	(c)		<b>Maximum of two from: (Improves precision)</b> use light gates/dataloggers ✓ measure time in milliseconds rather than seconds ✓ <b>Maximum of two from: (Improves accuracy)</b> Increase the distance / length of the ramp ✓ Repeat the experiment to find a mean and identify anomalous results ✓ Repeat the experiment with different gradients ✓	3	3.3b	Candidates must comment on both accuracy and precision to score 3 marks

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Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	<p><b>Any two from:</b>            over time (1960-2010) mean blood cholesterol levels for men have fallen ✓            over time (1960-2010) mean blood cholesterol levels for women have fallen ✓            men have lower mean blood cholesterol levels than women ✓            the fall in cholesterol levels over time was greater for women than for men (1mg/dL) ✓</p>	2	3.2b	<p><b>ALLOW</b> any correct conclusion</p> <p><b>ALLOW</b> ORA</p>
		(ii)	<p><b>Any one from:</b>            Collect a greater range of samples / increase sample size ✓            sample a greater range of ages ✓            equal sample size for men and women ✓            sample a greater range of ethnicities ✓            sample a greater range of areas e.g urban/rural ✓</p>	1	3.2a	<b>ALLOW</b> any correct suggestion
		(iii)	<p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b>  <b>If answer is 12% award 3 marks</b></p> <p>220 - 194 = 26 ✓  <math>(26 \div 220) \times 100 = 11.81818182</math> ✓            = 12 (2sf) ✓</p>	3	2.2 x 2 1.2	<b>ALLOW</b> any correct conversion to 2 sig figs.
	(b)	(i)	<p><b>Any two from:</b>            very few people develop cardiovascular disease without any risk factors ✓            males have slightly more risk factors than females ✓            around 98% of those sampled had at least one risk factor ✓            very few people had six or more risk factors ✓</p>	2	3.2b	<p><b>ALLOW</b> any correct conclusion drawn from the data</p> <p><b>ALLOW</b> % conclusions based on each category</p>
		(ii)	<p><b>Any one from:</b>            (To combat obesity) lose weight ✓            (To combat a lack of physical activity) be more active ✓            (To combat high blood cholesterol) take statins ✓            (To combat poor diet) eat more healthy food ✓            (To combat high blood pressure) take medication ✓            (To combat smoking) stop smoking ✓            (To combat alcohol use) reduce alcohol consumption ✓</p>	1	1.1	<b>ALLOW</b> any answer that correctly describes the reduction of one of the risk factors for cardiovascular disease

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Question		Answer	Marks	AO element	Guidance
5	(a)	Electron Ions +1 Electron Ions -1 ✓✓✓✓	3	2.1	Electrons = 1 mark Ions = 1 mark +1 and -1 = 1 mark  <b>ALLOW</b> 1 mark for the first 3 missing words correctly identified (potassium) <b>OR</b> second 3 missing words correctly identified (bromine) if no other mark is scored.
	(b)	<b>Any one from:</b> <b>(group 1)</b> good electrical conductors ✓ good thermal conductors ✓ react with water ✓ react with moist air ✓ Shiny / lustrous when cut ✓ Soft and can be easily cut ✓  <b>Any one from:</b> <b>(group 7)</b> do not conduct electricity ✓ have low melting points ✓ have low boiling points ✓	2	1.1	<b>DO NOT ALLOW</b> group 1 react with group 7 or vice versa  <b>ALLOW</b> any correct property

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Question		Answer	Marks	AO element	Guidance
6	(a)	<p><b>Any three from:</b>            Measure original length of the spring (without mass) ✓            place a mass on the spring and measure the new length of the spring ✓            Measure the length in mm ✓            use a range of masses / example of masses to be used ✓            Calculate (mean) extension ✓</p> <p><b>AND any one from: (accuracy).</b>            wait for the spring to stop moving before taking the measurement ✓            use the pointer to determine the measurement ✓            Repeat each measurement of length 3 times / repeat the experiment 3 times with the same spring ✓</p>	4	2.2	
	(b)	<p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b>  <b>If answer = 4 (N/m) award 4 marks</b></p> <p>Spring constant = force exerted by a spring ÷ extension ✓</p> <p>50mm converted to m = 0.05m ✓</p> <p>Convert mass to weight <math>0.02\text{g} \times 10 = 0.2\text{N}</math> ✓</p> <p><math>0.2 \div 0.05 = 4</math> ✓</p>	4	1.2 x 2  2.1 x 2	
	(c)	<p>(at 30g) the material is no longer elastic so does not return to its original shape ✓            (at 30g) the material has become plastic / the spring has reached/exceeded it's elastic limit ✓            the material is permanently distorted/plastic deformation ✓</p>	3	2.1	<b>ALLOW</b> higher level answers that use the particle model to explain the difference between elastic and plastic deformation

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Question	Answer	Marks	AO element	Guidance
7	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b>            Explain several factors that affect the decision to recycle plastic bottles <b>AND</b> include supporting calculations  <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><b>Level 2 (3–4 marks)</b>            Explain some factors that affect the decision to recycle plastic bottles <b>AND</b> include a supporting calculation  <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b>            List some factors that affect the decision to recycle plastic bottles <b>OR</b> include a calculation  <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><b>0 marks</b>  <i>No response or no response worthy of credit.</i></p>	6	2 x 2.1 4 x 3.2a	<p><b>AO2.1 Apply knowledge and understanding of scientific ideas</b></p> <p><b>Factors to be considered.</b></p> <ul style="list-style-type: none"> <li>• Energy use (in obtaining raw materials, production of bottles and disposal of waste)</li> <li>• Cost of recycling</li> <li>• Ease of recycling</li> <li>• Disposal options</li> <li>• Environmental impact</li> <li>• Can the bottles be reused</li> </ul> <p><b>AO3.2a Analyse information and ideas to make judgements - uses calculations to support recycling</b></p> <ul style="list-style-type: none"> <li>• Energy used in manufacture from raw materials is <math>8.810 \times 10^6 + 1.687 \times 10^6 = 10.497 \times 10^6 \text{ J}</math></li> <li>• Energy used in production per bottle through recycling is <math>1.688 \times 10^6</math></li> <li>• Using recycled pellets to make new bottles uses 84% less energy or <math>10.497 / 1.688 = 6.2</math>, so uses about 6 x less energy ORA</li> <li>• Energy use in incineration of bottles is more than the energy used in recycling the bottles</li> <li>• Total energy cost from raw material to incineration is <math>1.2517 \times 10^7 \text{ J}</math></li> </ul>

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Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	<b>Any two from:</b> concentration of (sodium hydrogencarbonate/carbon dioxide) solution ✓ temperature ✓ using the same piece of pondweed each time. ✓ Same lamp ✓	2	2.2	
		(ii)	move the lamp to different distances from the pondweed ✓	1	2.2	
	(b)		inversely square distance ✓✓	2	1.2	All 3 correct scores 2 marks 2 or 1 correct scores 1 mark
	(c)	(i)	all plots correct ✓ line of best fit ✓	2	2.2	<b>ALLOW</b> plots within ½ square
		(ii)	(after 600ppm) the rate of photosynthesis remains constant / reaches a maximum ✓  carbon dioxide is no longer a limiting factor ✓ light intensity/temperature is a limiting factor ✓	3	3.1a  3.2b x 2	
	(d)	(i)	global temperatures fluctuate ✓ overall the general trend is that global temperatures have risen ✓	2	3.1	<b>ALLOW</b> any correct comment comparing two different data points e.g. temperature in 1910 is lower than that in 1980
		(ii)	<b>Any two from:</b> Graph of the observations do not match the pattern of natural factors ✓ Observed rise must be a result of human factors (not natural alone) ✓ human factors such as burning fossil fuels / industrialisation could account for the difference ✓ human factors such as deforestation could account for the difference ✓	2	3.2a	

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