

GCSE (9–1)

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

J260/04: Combined Science (Foundation 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
	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.

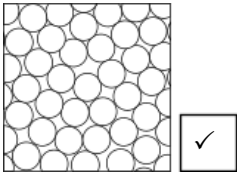
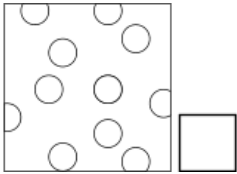
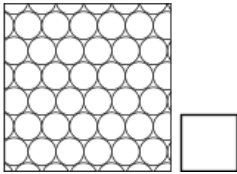
You should ensure that you have copies of these materials.

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 B:

	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	(a)	(i)						1	1.1		
		(ii)	density = weight ÷ volume	<input type="checkbox"/>					1	1.1	
			density = volume × mass	<input type="checkbox"/>							
			density = mass ÷ volume	<input checked="" type="checkbox"/>							
			density = volume ÷ mass	<input type="checkbox"/>							
	(b)		(D)	A	E	C	B	✓ ✓	2	2 x 2.2	four correct = 2 marks two or three correct = 1 mark one correct = 0 marks

Question		Answer	Marks	AO element	Guidance
2	(a)	DNA ✓	1	1.1	ALLOW deoxyribonucleic acid
	(b) (i)	James ✓	1	3.2a	
	(b) (ii)	Ali ✓	1	3.2a	
	(b) (iii)	Layla ✓	1	3.2a	
	(c)	stationary phase ✓ mobile phase ✓ locating agent ✓	3	3 x 2.2	
	(d) (i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.36 to 0.40 award 3 marks 3.8(cm) or 38(mm) ✓ = $3.8 \div 10$ or $38 \div 100$ ✓ = 0.38 ✓	3	2.2 x3	ALLOW between 3.6(cm) and 4.0(cm) or 36(mm) and 40(mm) (can be seen as numerator of the division) IGNORE units in final answer
	(d) (ii)	pencil is not soluble in water/will not dissolve / insoluble ✓ (so) line will not move ✓	2	2 x 2.2	ORA for answers in terms of pen/ink IGNORE answers about rubbing out pencil ALLOW idea of pencil not dissolving ALLOW idea of pencil mark not moving/smudging/spreading/affecting/interfering
	(d) (iii)	Any two from: Red tomatoes contain one pigment/ are pure ✓ Blue tomatoes contain two/more pigments/are impure/ a mixture ✓ Blue tomatoes contain the same pigment as red tomatoes ✓ Blue/top pigment is more soluble than red / ORA ✓	2	2 x 3.2b	IGNORE comments about rf values/distances IGNORE answers unrelated to dyes and pigments or number of blobs ALLOW colours/dyes/inks/extracts/dots for pigments – must be plural

Question			Answer	Marks	AO element	Guidance										
3	(a)	(i)	<table border="0" style="width: 100%;"> <tr> <td style="text-align: center; width: 50%;">Hazard</td> <td style="text-align: center; width: 50%;">Safety procedure</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">The hot lamp could cause burns</td> <td style="border: 1px solid black; padding: 2px;">Wear long sleeves and gloves</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">UV damage to the skin</td> <td style="border: 1px solid black; padding: 2px;">Keep hands dry at all times</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">Electric shock from equipment</td> <td style="border: 1px solid black; padding: 2px;">Let the lamp cool before touching it</td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">UV damage to the eyes</td> <td style="border: 1px solid black; padding: 2px;">Wear sunglasses</td> </tr> </table>	Hazard	Safety procedure	The hot lamp could cause burns	Wear long sleeves and gloves	UV damage to the skin	Keep hands dry at all times	Electric shock from equipment	Let the lamp cool before touching it	UV damage to the eyes	Wear sunglasses	3	3 x 3.3b	<p>four correct = 3 marks</p> <p>two or three correct = 2 marks</p> <p>one correct = 1 mark</p> <p>zero correct = 0 marks</p>
Hazard	Safety procedure															
The hot lamp could cause burns	Wear long sleeves and gloves															
UV damage to the skin	Keep hands dry at all times															
Electric shock from equipment	Let the lamp cool before touching it															
UV damage to the eyes	Wear sunglasses															
	(a)	(ii)	<p>Keep the lamp at the same UV intensity for each test ✓</p> <p>The distance between lamp and plastic sheet should be kept the same ✓</p>	2	2 x 3.3a											
	(b)		<p>A <u>control</u> (variable) ✓</p> <p>To compare (the other results to) ✓</p>	2	2 x 3.3a	<p>IGNORE fair test/accuracy/precision/reliable/reproducibility</p> <p>ALLOW idea of comparison – e.g. to see what happens without sunscreen/to see the difference/to see if the results were the same</p> <p>DO NOT ALLOW references to burning/people/skin/damage</p>										
	(c)	(i)	<p>FIRST CHECK THE ANSWER ON ANSWER LINE</p> <p>If answer = 30 (mW/cm²) award 2 marks</p> <p>149 ÷ 5 OR 29.8 ✓</p> <p>30 (mW/cm²) (2 sig. figs.) ✓</p>	2	<p>2.2</p> <p>1.2</p>											
		(ii)	They recorded the intensity with a UV intensity meter ✓	1	3.3a											

Question		Answer	Marks	AO element	Guidance
(d)	(i)	<p>SPF/Sun protection factor on x-axis, mean UV intensity on y axis <u>and</u> correct units mW/cm² on y axis ✓</p> <p>All points plotted correctly ✓</p> <p>Correct line of best fit ✓</p>	3	3 x 2.2	<p>IGNORE any units on horizontal axis</p> <p>ALLOW plots within half a square IGNORE bar charts</p> <p>ALLOW ECF for line of best fit based on their points</p>
	(ii)	<p>Any two from: The higher the SPF, the lower the UV/ there is an inverse relationship/negative correlation ✓</p> <p>Small difference between SPF's ✓</p> <p>(All) sunscreen reduces UV ✓</p> <p>OR</p> <p>(Any) sunscreen gives a large reduction in UV / Credit calculation of reduction e.g. 672 or 90-98% ✓✓</p>	2	2 x 3.2b	<p>IGNORE references to sunburn/cancer ALLOW radiation for UV</p> <p>ALLOW stronger for higher/weaker for lower IGNORE (inversely) proportional</p> <p>ALLOW sunscreen blocks UV ALLOW sunscreen protects against <u>UV</u></p>
(e)		<p>(UV causes) cell damage / change in DNA / (sun)burn / mutation ✓</p> <p>(Can lead to skin) cancer ✓</p>	2	1.1 2.1	<p>ALLOW skin damage / kills cells / ionises</p> <p>ALLOW ageing / wrinkling / tumour</p>

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	(top part of flow diagram) sensory receptor ✓ (bottom part of flow diagram) motor neuron ✓	2	2 x 1.1	
		(ii)	enzymes / chemical reactions / catalysts ✓ work best at/optimum temperature 37°C ✓	2	2 x 1.1	ALLOW (enzymes) denature at higher temperatures
		(iii)	insulators ✓ low ✓ lost ✓	3	3 x 2.1	
		(iv)	Blood sugar levels ✓ Water balance ✓	2	2 x 1.1	

<p>(b)*</p>	<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) Correct calculations of both speeds AND Information about speed in table interpreted AND An explanation of the link between speeds and the fatty sheath</p> <p><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) Correct calculations of both speeds AND An attempt at interpreting information in the table to explain the speed</p> <p><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) Correct calculations of both speeds OR An attempt at describing information in the table</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>0 marks No response or no response worthy of credit.</p>	<p>6</p>	<p>2 x 2.2 2 x 2.1 2 x 3.2b</p>	<p>AO2.2 Application of knowledge and understanding of techniques</p> <ul style="list-style-type: none"> • sensory neuron = 108 (m/s) • relay neuron = 1.6 (m/s) <p>AO3.2b Analyse information and ideas to draw conclusions</p> <ul style="list-style-type: none"> • speed of impulse in sensory <u>and</u> motor neurons are much faster than relay • sensory <u>and</u> motor neuron impulses have similar speeds • some attempt at mathematical comparison between relay and other neurons (approximately 65 – 75 times faster) • longer neurons have faster impulses <p>AO2.1 Application of knowledge and understanding of scientific ideas related to neurons</p> <ul style="list-style-type: none"> • sensory <u>and</u> motor neurons have a fatty sheath • relay neurons do not have a fatty sheath • fatty sheath insulates neuron • fatty sheath results in (much) faster transmission of impulse <p>ALLOW myelinated for fatty sheath</p>
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Question		Answer	Marks	AO element	Guidance												
5	(a)	<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.2 (%) award 4 marks</p> <p>sight of 150 <u>and</u> 100 000 ✓</p> <p>$150 \div 100\ 000$ ✓</p> <p>= 0.0015 ✓</p> <p>= 0.2 (%) (1dp) ✓</p>	4	<p>2.2</p> <p>2.2</p> <p>2.2</p> <p>1.2</p>	ALLOW for 4 marks if candidates use 410 instead of 100 000 and get 36.6 (%).												
	(b)	(i)	3	3 x 3.1a	ALLOW true for statement 'a line of best fit can be drawn on the graph' due to the context of the question												
		<table border="1"> <thead> <tr> <th>Statement</th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>There is a weak positive correlation between the percentage of TB cases.....</td> <td>✓</td> <td></td> </tr> <tr> <td>There are three countries where the percentage of TB cases.....</td> <td>✓</td> <td></td> </tr> <tr> <td>A line of best fit can be drawn on the graph.</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Statement	True	False	There is a weak positive correlation between the percentage of TB cases.....	✓		There are three countries where the percentage of TB cases.....	✓		A line of best fit can be drawn on the graph.		✓			
Statement	True	False															
There is a weak positive correlation between the percentage of TB cases.....	✓																
There are three countries where the percentage of TB cases.....	✓																
A line of best fit can be drawn on the graph.		✓															
	(b)	(ii)	1	1.2													
		As the value of one variable increases, the value of the other tends to increase. ✓															

Question		Answer	Marks	AO element	Guidance
	(c)		2	2 x 3.3b	three correct = 2 marks one or two correct = 1 mark

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	Any two from: Incomplete combustion / not complete combustion ✓ Not enough oxygen ✓ Particulates/(unburnt) carbon ✓	2	2 x 2.1	ALLOW soot for particulates
		(ii)	evaporate ✓ cooled ✓	2	2 x 1.1	
		(iii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = C₄H₉ award 3 marks ratio of C:H = 8:18 ✓ simplest ratio = 4:9 ✓ C ₄ H ₉ ✓	3	3 x 2.2	ALLOW 2 marks for the correct displayed formula of C ₄ H ₉ NOT C ₈ H ₁₈ alone as this is in the stem of the question
	(b)		Max. any two for any 2 similarities from: (both are) mixtures ✓ (both contain) LPG ✓ (both contain) Petrol ✓ (both contain) Diesel ✓ diesel and petrol form roughly the same proportion (~15% each in crude oil/~30% each in condensate oil) of each mixture ✓ Max. any two for any 2 differences from: crude oil has more fractions / condensate has fewer fractions / crude oil has 7 fractions and condensate has (only) 3 fractions ✓ (only) crude oil has residue ✓ (only) crude oil has fuel oil ✓ (only) crude oil has heating oil ✓ (only) crude oil has paraffin ✓ crude oil has less LPG ✓ crude oil has less petrol ✓ crude oil has less diesel ✓ condensate has equal distribution of fractions ✓	4	4 x 3.1a	ALLOW ORA throughout

	(c)	(i)	The oils contain different fractions ✓	1	3.1a	
		(ii)	<p>Identification of property of condensate (condensate oil) has lower flash point / lower temperature the vapour will catch fire ✓ is less viscous ✓</p> <p>Max. two from: Identification of danger/environmental effect (has lower flash point) – more likely to catch fire/explode ✓ (is less viscous) – more likely to move/leak out/spread ✓ (is less viscous) idea of less environmental issues with condensate such as easier to clean animals and beaches ✓</p>	3	3 x 3.1b	<p>To score 3 marks candidates should identify either two properties and link one of these to a correct danger OR identify two dangers and link one of these to a property</p> <p>ORA for crude oil IGNORE boiling point, colour and density ALLOW alternative wording for viscosity e.g. runny</p> <p>Property comparison must be explicit to score the mark e.g. quoting data or information from the table such as 'thick liquid' without comparison does not score</p>

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