F

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

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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
	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.

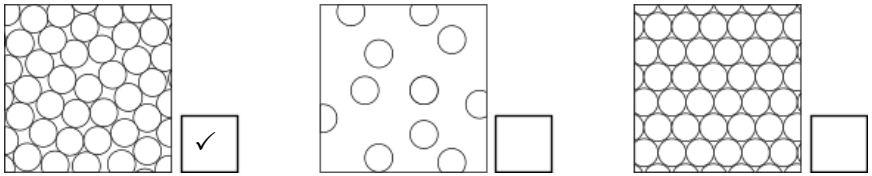
You should ensure that you have copies of these materials.

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**.

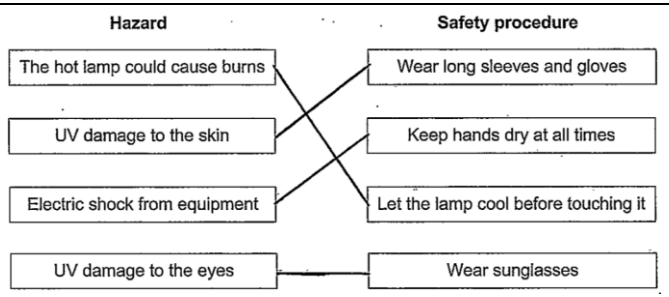
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

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 ☐ density = volume × mass ☐ density = mass ÷ volume ✓ density = volume ÷ mass ☐	1	1.1	
	(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 ÷ 10 or 38 ÷ 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)		3	3 x 3.3b	four correct = 3 marks two or three correct = 2 marks one correct = 1 mark zero correct = 0 marks
	(a)	(ii)	Keep the lamp at the same UV intensity for each test ✓ The distance between lamp and plastic sheet should be kept the same ✓	2	2 x 3.3a	
	(b)		A <u>control</u> (variable) ✓ To compare (the other results to) ✓	2	2 x 3.3a	**IGNORE** fair test/accuracy/precision/ reliable/reproducibility **ALLOW** idea of comparison – e.g. to see what happens without sunscreen/to see the difference/to see if the results were the same **DO NOT ALLOW** references to burning/people/skin/damage
	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 30 (mW/cm^2) award 2 marks** 149 ÷ 5 **OR** 29.8 ✓ 30 (mW/cm^2) (2 sig. figs.) ✓	2	 **2.2** **1.2**	
		(ii)	They recorded the intensity with a UV intensity meter ✓	1	3.3a	

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

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	

	(b)*		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)** Correct calculations of both speeds **AND** Information about speed in table interpreted **AND** An explanation of the link between speeds and the fatty sheath *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)** Correct calculations of both speeds **AND** An attempt at interpreting information in the table to explain the speed *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)** Correct calculations of both speeds **OR** An attempt at describing information in the table *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **0 marks** *No response or no response worthy of credit.*	**6**	**2 x 2.2** **2 x 2.1** **2 x 3.2b**	**AO2.2 Application of knowledge and understanding of techniques** • sensory neuron = 108 (m/s) • relay neuron = 1.6 (m/s) **AO3.2b Analyse information and ideas to draw conclusions** • 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 **AO2.1 Application of knowledge and understanding of scientific ideas related to neurons** • 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 **ALLOW** myelinated for fatty sheath

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td></td><td>FIRST CHECK THE ANSWER ON ANSWER LINE
If answer = 0.2 (%) award 4 marks

sight of 150 <u>and</u> 100 000 ✓

150 ÷ 100 000 ✓

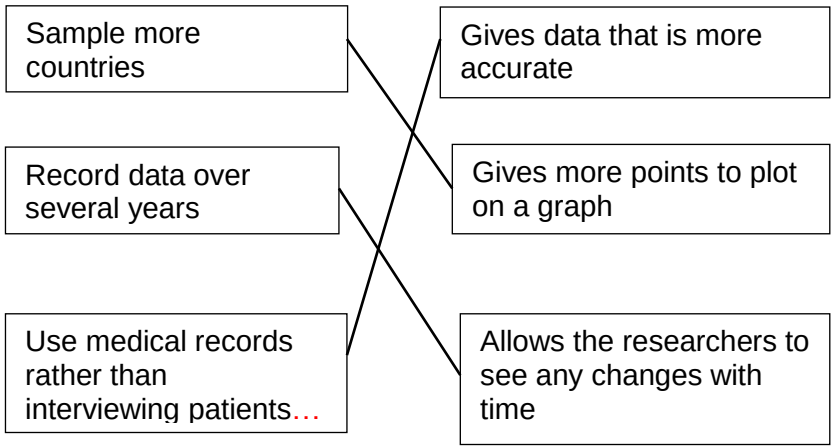
= 0.0015 ✓

= 0.2 (%) (1dp) ✓</td><td>4</td><td>2.2

2.2

2.2

1.2</td><td>ALLOW for 4 marks if candidates use 410 instead of 100 000 and get 36.6 (%).</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><table><tr><th>Statement</th><th>True</th><th>False</th></tr><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></table></td><td>3</td><td>3 x 3.1a</td><td>ALLOW true for statement ‘a line of best fit can be drawn on the graph’ due to the context of the question</td></tr>
<tr><td></td><td>(b)</td><td>(ii)</td><td>As the value of one variable increases, the value of the other tends to increase. ✓</td><td>1</td><td>1.2</td><td></td></tr>
</table>

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 = C_4H_9 award 3 marks** ratio of C:H = 8:18 ✓ simplest ratio = 4:9 ✓ C_4H_9 ✓	**3**	**3 x 2.2**	**ALLOW** 2 marks for the correct displayed formula of C_4H_9 **NOT** C_8H_{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)	**Identification of property of condensate** (condensate oil) has lower flash point / lower temperature the vapour will catch fire ✓ is less viscous ✓ **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 ✓	**3**	**3 x 3.1b**	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 **ORA** for crude oil **IGNORE** boiling point, colour and density **ALLOW** alternative wording for viscosity e.g. runny 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

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