OCR
Oxford Cambridge and RSA

GCSE (9-1)

Combined Science B (Twenty First Century)

Unit **J260/08**: Combined Science

General Certificate of Secondary Education

Mark Scheme for June 2018

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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
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

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.

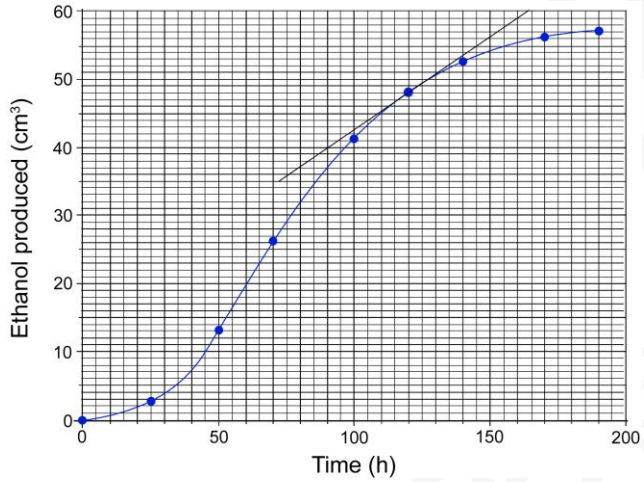
The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science B:

	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)		**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 29000 award 2 marks** 145000 x 0.20 / 145000 ÷ 5 ✓ = 29000 ✓	**2**	**2 x 2.2**	**ALLOW** 145 000 x 1.2 **OR** 174 000 ✓ **ALLOW** 29000 seen in working but not final answer for maximum 1 mark
	(b)		**Any one from:** Risk (of developing Parkinson's disease) is lower in (former) smokers / is higher in non-smokers ✓ Risk (of developing Parkinson's disease) is low**est** in current smokers ✓ **Any one from:** (Approximately) 41% of patients are former smokers ✓ (Approximately) 8% are current smokers ✓ (Approximately) 50% of the patients have never smoked ✓	**2**	**3.1a** **3.1b**	
	(c)	**(i)**	**Any two from:** increase in speed / (kinetic) energy ✓ (Particles) move apart ✓ changes (from a liquid) to a gas / vapour ✓	**2**	**2 x 2.1**	**ALLOW** idea of vibrate or move around **more** **ALLOW** overcome weak intermolecular forces **ALLOW** evaporates / boils

Question			Answer	Marks	AO element	Guidance
		(ii)	Comparison of e-cigarette is a physical change and cigarette is a chemical change ✓	1	2.1	**ALLOW** new products formed (including gases) in cigarettes
	(d)	(i)	Ali ✓	1	3.1b	
		(ii)	Sarah ✓	1	3.1b	
	(e)*		*Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question*. **Level 3 (5–6 marks)** Analyses data to form reasoned conclusions about the relative risk and presence or lack of correlation. *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)** Analyses some data to form conclusions about the risk and presence or lack of correlation. *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)** Identifies foods from the data that change the risk of Parkinson's disease. *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 × 3.1a** **3 × 3.2b**	**AO3.1a Analyse data** For example: • reduction of risk linked with eating all foods except tomato juice • peppers - 0.24 reduced risk (conc. 102) • tomatoes – 0.58 reduced risk (conc. 44) • potatoes – 0.92 reduced risk (conc. 19) • tomato juice – 2.16 increases risk (conc. 30) **AO3.2b Analyse information to make conclusions/correlations** • Idea that results from tomato juice suggest that other factors may be involved. • Correlations imply that nicotine-containing foods give protection against Parkinson's disease • Portion may alter risk • Comparative statements about risk • Correlation ideas limited by small sample size • other factors may be involved in patients who ate nicotine-containing foods

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	110 (mm)	1	2.2	**ALLOW** 110.1
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 150 (ms) award 5 marks** 110(mm) converted to 0.11(m) ✓ Substitution of numbers $= \sqrt{\frac{2 \times 0.11}{9.81}}$ ✓ = 0.14975345 ✓ Convert to milliseconds = 149.8 (ms) ✓ Significant figures =150 (ms) (3 sig. figs) ✓	5	 1.2 2.2 2.2 2.2 1.2	**ALLOW** ECF for value from (a)i. **ALLOW** Standard form answers
	(b)		**Any four from:** (Nerve impulses) pass along sensory neurone ✓ nerve impulses sent to CNS / brain / spinal cord ✓ (nerve impulses travel) along relay neurons / down spinal cord ✓ Then along motor neuron ✓ To effector / muscles ✓ That cause movement of hand (to catch ruler) ✓	4	4 x 1.1	

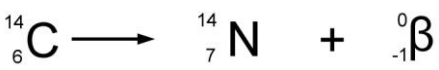
Question			Answer	Marks	AO element	Guidance
3	(a)		2, 2 ✓	1	2.1	Both must be correct for mark.
	(b)	(i)	**Any one from:** Colour change / colorimetry ✓ Formation of a precipitate ✓ Change in temperature / mass / volume of gas ✓	1	1.2	
		(ii)	 Draw tangent (at or over 120 h) ✓ Select **two** suitable points to calculate gradient from the tangent ✓ Interpolate values of x and y at these **two** points ✓ Uses formula to calculate rate ✓ Correct answer given ✓	5	 1.2 2.2 2.2 1.2 2.2	Must show tick or cross on graph **ALLOW** 0.129 / 0.13 for 5 marks **ALLOW** +/- ½ small square If no tangent drawn only award last 2 marking points For example: $rate\ of\ reaction = \frac{change\ in\ amount}{change\ in\ time}$ $= \frac{59-36}{160-75} = \frac{23}{85} = 0.27 cm^3 / h$

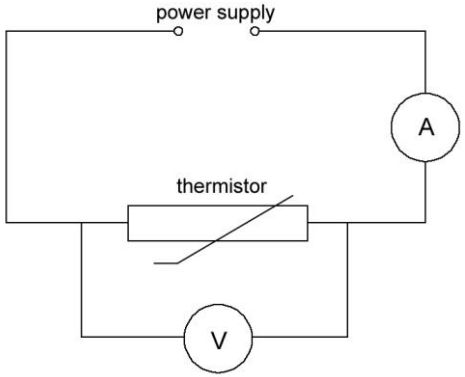
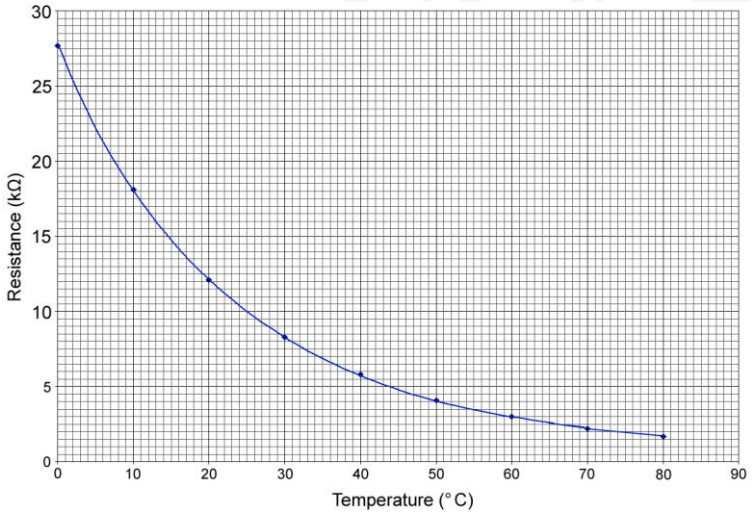
Question			Answer	Marks	AO element	Guidance
	(c)	(i)	**Any one from:** Increasing temperature increases rate up to the optimum / decreases the rate after the optimum temperature ✓ Optimum temperature = 32.5°C ✓ **Any two from:** After 32.5°C enzymes in yeast denature ✓ Activity of enzyme drops after optimum temperature ✓ Active site in enzyme changes so that the reactant no longer fits ✓ Uses ideas of collision theory to explain the effect of temperature on the rate of reaction ✓	**3**	**3.1a** **3.2b x2**	**ALLOW** 32-33 for optimum temperature (½ small square)
		(ii)	**Any two from:** Make measurements at smaller intervals of temperature; ✓ Specified intervals, e.g. 1 °C/0.5 °C ✓ Identifies a suitable temperature range / around the optimum temperature ✓	**2**	**2 x 3.3b**	**ALLOW** any interval less than 5°C Example of a suitable range might be 30 °C to 35 °C

Question			Answer	Marks	AO element	Guidance
	(d)		**Any two from:** Starting materials for fermentation renewable / sustainable / more readily available / ORA ✓ ethene is also important as chemical feedstock ✓ Less energy /energy costs are lower for fermentation ✓ Fermentation uses low**er** temperature/ energy requirement / ORA ✓ Fermentation uses low**er** pressure / the industrial production uses high pressure ✓ Reaction of ethene reversible / reaction comes to equilibrium ✓	**2**	**2 × 2.1**	Take 'it' as referring to the fermentation reaction **ALLOW** Safety argument qualified e.g. safer as no phosphoric acid is used.

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	F ✓ T ✓ T ✓	3	2.1 3.1a 3.1a	
		(ii)	**OPEN-LOOP Recycling** **Any four from:** Sort PET waste ✓ Grind to flake / shredded / cut into pieces ✓ Separate contaminants ✓ Washed / clean ✓ Dried ✓ Melted (into pellets) ✓ (Flake) converted directly to useful products ✓ **OR** **CLOSED-LOOP Recycling** **Any four from:** Sort PET waste ✓ Clean PET waste ✓ converted to monomers / depolymerised ✓ Repolymerise the pure monomer/ new PET synthesised ✓ PET/ polymer granules made into new (food-grade) products ✓	4	4 × 1.1	**ALLOW** named useful products e.g. carpets, non-food containers, filling for pillow, quilts and jackets.

Question			Answer	Marks	AO element	Guidance
	(b)	(i)	**Any one from:** Less energy costs ✓ Easy to culture bacteria (so more bottles could be broken down) ✓	**1**	**2.1**	
		(ii)	**Any three from:** Bacteria didn't need to adapt before 1973 ✓ Bacteria mutated (after 1973) ✓ Mutation allows the bacteria to break down PET ✓ By producing an enzyme / mutation allows bacteria to use PET as a food source ✓ Long time for bacteria to evolve / mutation to be observed (43 years) ✓ Bacteria have selective advantage (over those without mutant gene allele) ✓ **PLUS** Gene / allele / variant spreads throughout population ✓	**4**	**3 × 3.1b** **2.1**	

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	1 mark for beta ✓ 2 marks for nitrogen isotope ✓✓ 	3	1.1 2 x 2.1	
		(ii)	5750 years ✓ Evidence of at least one correct half-life construction on the graph ✓	2	1.2 3.1b	**ACCEPT** answers to ± 250 years Must indicate a tick or cross on graph
	(b)	(i)	Concentration of ^{14}C in the environment has remained constant ✓	1	2.1	**ALLOW** idea that no more carbon(-14) enters the body after death
		(ii)	Half-life of ^{14}C is short ✓ Half-life of ^{40}K is long ✓ **Any three from:** ^{14}C has little activity after millions of years / small amounts of ^{14}C left in the fossil ✓ Idea that ^{14}C decays too quickly (to date fossils) ✓ Idea that ^{40}K decays slowly enough (to date much older objects / fossils from millions of years ago) ✓ (^{40}K present is large enough) to give accurate estimation of age of the fossils✓ All ^{40}Ar must be derived from ^{40}K ✓	5	2 x 3.1a 3 x 3.2b	**ALLOW** Comparative statement of ^{40}K half-life longer than ^{14}C for 2 marks **ALLOW** almost all ^{14}C has decayed after 45,000 years (from graph) **ALLOW** ^{14}C decays more quickly / ORA for 2 marks
	(c)		In (the king's) diet/as food ✓	1	3.2a	**ALLOW** breathed in / from air

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	Ammeter in series and voltmeter in parallel ✓ Correct symbol for thermistor ✓ 	2	2 x 2.2	
		(ii)	Points plotted correctly ✓ Line of best fit drawn ✓ 	2	2× 2.2	Must have all point within ½ small square I**GNORE** extrapolation beyond 80°C

Question			Answer	Marks	AO element	Guidance
	(b)	(i)	**FIRST CHECK GRAPH FOR CANDIDATE EXPECTED VALUE** Reads value from the graph ✓ Substitute value into the equation and evaluate V_{out} = (10 ÷ (value from graph + 10)) x 10 = evaluated correctly ✓ Convert to 1 decimal place ✓	**3** **2 × 2.2** **1.2**		**ALLOW** ECF from their graph **ALLOW** ± ½ small square (0.25) for reading from graph. Example calculation V_{out} = (10 ÷ (14.5 + 10)) x 10 = 4.08
		(ii)	Voltage increases ✓	**1**	**3.2b**	
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.00077 (A) award 4 marks** Total resistance = R_1 + R_2 = 3000 + 10 000 = 13 000 ✓ Recall and rearrange I = V ÷ R✓ = 10 ÷ 13000 ✓ = 0.00077 (A) ✓	**4** **2.2** **1.2** **2 x 2.1**		**ALLOW** 7.7 x 10^{-4} or 77mA for 4 marks

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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