OCR
Oxford Cambridge and RSA

GCSE (9-1)

Combined Science A (Gateway)

Unit **J250/04**: Chemistry

General Certificate of Secondary Education

Mark Scheme for June 2018

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
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 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.

Question			Answer	Marks	AO element	Guidance
1			D ✓	1	2.2	
2			D ✓	1	1.1	
3			B ✓	1	1.1	
4			C ✓	1	1.1	
5			D ✓	1	1.1	
6			C ✓	1	1.1	
7			C ✓	1	1.1	
8			C ✓	1	2.1	
9			C ✓	1	2.1	
10			A ✓	1	2.1	

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
11	(a)	(i)	6 points plotted correctly ✓✓	2	2 x 2.2	**ALLOW** ± ½ square 4 points plotted correctly 1 mark.
		(ii)	curve passing through all the points ✓	1	2.2	ecf on their points one line, not feathery, not thicker than half a small square
	(b)	(i)	20 (minutes) ✓	1	2.2	
		(ii)	1.45 (g) ✓	1	2.2	**ALLOW** 1.4 to 1.5
	(c)		idea that slope or gradient of line for small chips is (twice as) steep(er) / ORA ✓ small chips reaction finishes (3 to 5 minutes) before (large chips reaction)/ ORA ✓	2	2 x 3.1b	**IGNORE** all points are higher (0 isn't) **ALLOW** line goes up faster **ALLOW** finishes earlier /small finishes at 16 and large at 20 **ALLOW** small chips get to 1.7 before the large chips **ALLOW** (smaller chips have) given off a larger mass in a named time/earlier
	(d)		same quantity (50cm3) of hydrochloric acid (was used in both) ✓	1	2.2	**IGNORE** references to amount of marble chips **ALLOW** concentration/amount/volume
	(e)		**any one from:** (gas) syringe ✓ measuring cylinder ✓	1	1.2	**ALLOW** burette

Question			Answer	Marks	AO element	Guidance
12	(a)		fractional distillation ✓	1	1.1	**ALLOW** fractionation
	(b)		**A** – LPG ✓ **B** – bitumen ✓	2	2 x 1.1	**ALLOW** petroleum gases **ALLOW** methane / ethane / propane / butane **ALLOW** tar (if blank check diagram)
	(c)	(i)	Molecules in petrol are small**er** (than those in diesel)/ORA ✓	1	1.1	**ALLOW** (molecules in) petrol are small**er** (number)/ short**er**/few**er** carbons / ORA **IGNORE** diesel is higher/petrol is lower/more in diesel/less in petrol
	(c)	(ii)	**Any 3 from:** Recognise intermolecular forces/intermolecular bonds are present ✓ Intermolecular forces/intermolecular bonds are smaller/weaker in petrol (molecules than in fuel molecules) ✓ Less energy/heat required to overcome forces in petrol / ORA ✓ Petrol boils at a lower temperature/has a lower boiling range / ORA ✓	3	3 x 1.1	**ALLOW** bonds between molecules **ALLOW** bonds between molecules **ALLOW** bonds **IGNORE** doesn't boil at a high temperature
	(d)		**UP TO TWO FROM:** (cracking) breaks large hydrocarbons / molecules into smaller ones ✓ (cracking) breaks (carbon-carbon) bonds ✓ alkene molecules also made ✓ **UP TO TWO FROM:** high temperature ✓ catalyst ✓	3	3 x 1.1	**ALLOW** breaks up large molecules / breaks into smaller molecules **IGNORE** separates **ALLOW** range between 450 to 800^{o}C **IGNORE** warm/heat/hot

Question			Answer	Marks	AO element	Guidance
						ALLOW named catalyst e.g. alumina / Al_2O_3 / aluminium oxide / silica / silicon dioxide / SiO_2 / zeolites / / china / broken pot / chromium oxide / Cr_2O_3
13			Volcanoes ✓ Condensed ✓ Nitrogen ✓ Oxygen ✓	**4**	4 x 1.1	

Question			Answer	Marks	AO element	Guidance
14	(a)		**order of reactivity (most to least)** magnesium zinc iron copper silver magnesium as most reactive and silver least reactive ✓ zinc, iron and copper in the correct order ✓ **Explanation** **Any two from:** idea that magnesium displaces all the other metals (from solutions of their salts so is most reactive) ✓ idea that silver does not displace any of the other metals (from solutions of their salts so is the least reactive) ✓ any other correct statement about displacement/reactions ✓	**4**	4 x 2.2	**ALLOW** magnesium reacts with **all** of the solutions **ALLOW** silver reacts with **none** of the solutions e.g. zinc displaces copper from copper sulfate solution so zinc is more reactive than copper/ more reactive metal displaces a less reactive metal (from solution) **IF no marks are awarded for explanation** then **MAX 1 mark** can be awarded for: in **order** of number of ticks / in **order** of the number of solutions it reacts with
	(b)		copper + silver nitrate → copper nitrate + silver ✓	**1**	2.2	**ALLOW** formulae equation fully balanced

Question			Answer	Marks	AO element	Guidance
15	(a)		0.6 (^{o}C) ✓	1	2.1	
	(b)		175 (ppm) ✓	1	2.1	**ALLOW** 165 -185 inclusive
	(c)		**Evidence to support increased temperature of the Earth** As carbon dioxide levels have increased so has the temperature of the Earth ✓ **Evidence for a natural cycle** idea that Earth's temperature goes up and down/fluctuates/erratic (over the years 1880 to 1920) **and** carbon dioxide levels are (slowly) rising ✓	2	2 x 2.1	**ALLOW** (the lines on) both graphs increase/go up

Question			Answer	Marks	AO element	Guidance
16*	(a)		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)** **Provides a detailed explanation of the evidence to support both conclusions** **AND** **States whose conclusion is correct with valid reasons** *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)** **Explains the evidence that supports both student A's and student B's conclusion** **OR** **States whose conclusion they think is correct quoting valid reasons** *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)** **Quotes evidence to support student A's OR student B's conclusion** **OR** **States whose conclusion they think is correct with a valid reason** *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**	1 x 1.1 2 x 2.1 2 x 3.1a 1 x 3.2b	**AO1.1 Demonstrates knowledge and understanding of the groups on the Periodic Table** • same number of electrons in outer shell means elements in the same group **AO2.1 Applies knowledge and understanding of Group properties** • element **Y** is sodium and **X** is lithium and **Z** is potassium/rubidium **AO3.1b Analyses information to interpret evidence from the table** Supporting student A's conclusion • melting points show a downward trend as Group is descended • similar reaction with water • formula of chlorides is the same Supporting student B's conclusion • density shows no clear trend / densities go up and then down again • action of heat on carbonates shows no clear trend or reactions are different • melting points of chlorides show an increase then a decrease as Group is descended **AO3.2b Analyses information to draw conclusions based on the analysis** • Student A is correct as same number of electrons in outer shell • Student A is correct as most evidence supports his viewpoint • Student B is correct as not all the evidence supports the idea that the elements are in the same group

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>17</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th colspan="2">Material A</th><th colspan="2">Material B</th></tr>
<tr><th></th><th>Energy used in MJ</th><th>Greenhouse gases made in g of CO_2</th><th>Energy used in MJ</th><th>Greenhouse gases made in g of CO_2</th></tr>
<tr><td>Extracting the raw materials</td><td>5.0</td><td>2.2</td><td>3.8</td><td>1.4</td></tr>
<tr><td>Manufacturing of the glass from the raw materials</td><td>0.4</td><td>0.3</td><td>0.4</td><td>0.1</td></tr>
<tr><td>Transporting the glass to the shops</td><td>1.5</td><td>1.0</td><td>3.1</td><td>2.2</td></tr>
<tr><td>Process W</td><td>2.0</td><td>0.6</td><td>5.0</td><td>1.7</td></tr>
<tr><td>Total</td><td>8.9</td><td>4.1</td><td>12.3</td><td>5.4</td></tr>
</table>
</td><td>2</td><td>2 x 2.2</td><td>All correct = 2 marks
2 or 3 correct = 1 mark
1 correct = 0 marks

IGNORE units</td></tr>
<tr><td></td><td>(b)</td><td></td><td>disposal (of the product) / end of life management / AW✓</td><td>1</td><td>1.1</td><td>ALLOW recycling / reuse / melting

IGNORE use of/selling product</td></tr>
<tr><td></td><td>(c)</td><td></td><td>idea that they could be heavier or more dense/ more energy or fuel used✓</td><td>1</td><td>2.1</td><td>ALLOW travels further

IGNORE packaging/fragile

IGNORE greenhouse gases</td></tr>
<tr><td></td><td>(d)</td><td></td><td>material A (no mark)
because
Any two from:
uses less (total) energy /8.9 less than 12.3 (MJ) or 3.4 (MJ) less✓

makes less (total) greenhouse gases/CO_2 or 4.1 less than 5.4 or 1.4 less✓</td><td>2</td><td>2 x 3.2a</td><td>ALLOW data from table throughout

ALLOW less global warming/climate change</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
			cheaper to transport ✓ Process W/disposal is cheaper ✓ (total) energy cost is less ✓			**MAX 1** mark if B chosen **and any one of**: Less energy used for extracting Less greenhouse gases produced for extracting Less greenhouse gases produced for manufacturing **ECF** for B from part (a) **MAX 2** marks **Any two from:** uses less (total) energy makes less (total) greenhouse gases/CO_2 Less energy used for extracting Less greenhouse gases produced for extracting Less greenhouse gases for manufacturing

Question			Answer	Marks	AO element	Guidance
18			**Any four from:** (plan should) state how to measure how fast gas is given off/ **AW**✓ use gas syringe or (upturned) measuring cylinder/burette (filled with water) / counting bubbles ✓ measure volume (of gas) given off in a fixed time ✓ **or** measure volume of gas every x seconds ✓ **or** could time how long until no more gas is given off or reaction has finished ✓ doubling the volume of acid does not double the concentration of acid✓ need to use an equal volume of acid✓ need to change the concentration ✓ use the same temperature ✓	**4**	2 x 3.3a 2 x 3.3b	 **ALLOW** balance/scales **ALLOW** amount for volume or mass throughout **ALLOW** mass in place of volume of gas if balance used **DO NOT ALLOW** volume in place of mass if balance used **ALLOW** changing the volume of acid does not change the concentration of acid **IGNORE** investigate how changing concentration affects rate **ALLOW** (always) use 50 cm^3 of acid **IGNORE** do repeats/carry out risk assessment

Question			Answer	Marks	AO element	Guidance
19	(a)		C_9H_{20} ✓	1	3.1a	**ALLOW** $H_{20}C_9$
	(b)		alkane(s) ✓	1	1.1	

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