OCR
Oxford Cambridge and RSA

GCSE (9-1)

Combined Science (Chemistry) A (Gateway Science)

Unit **J250/10**: Paper 10, C4-C6 and CS7 (PAGs C1-C5) (Higher Tier)

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
A	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 Biology/Chemistry/Physics/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			C ✓	1	1.1	
2			D ✓	1	1.1	
3			C ✓	1	1.1	
4			A ✓	1	1.1	
5			D ✓	1	1.1	
6			D ✓	1	1.1	
7			D ✓	1	1.1	
8			B ✓	1	1.1	
9			C ✓	1	1.1	
10			B✓	1	1.1	

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>11</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>
</table>

Question	Answer	Marks	AO element	Guidance
(d)	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✓ cheaper to transport ✓ Process W/disposal is cheaper ✓ (total) energy cost is less ✓	**2**	2 x 3.2a	**ALLOW** data from table throughout **ALLOW** less global warming/climate change **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 for **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
12			**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
13	**(a)**		C_9H_{20} ✓	**1**	3.1a	**ALLOW** $H_{20}C_9$
	(b)		alkane(s) ✓	**1**	1.1	

Question			Answer	Marks	AO element	Guidance
14	(a)	(i)	Small chips rate of reaction = 0.18 ✓ Large chips rate of reaction = 0.10 ✓ Units (for either size) = g/min ✓	3	3 x 2.2	**ALLOW** 0.175 (for small) and 0.1 (for large) for 1 mark for rate calculations **ALLOW** for 1 mark 5.71 and 10.00 in that order with inverted calculations shown. **ALLOW** g/s or g/sec if minutes converted to seconds **DO NOT ALLOW** g/m for both
		(ii)	small chips (No mark) because **any two from:** rate of reaction is greater over first 8 minutes / more gas is made in first 8 minutes/in same time ✓ (slope of graph) is steeper/has larger gradient ✓ reaction with small chips finishes sooner/(graph) levels off first ✓	2	2 x 3.2b	**ECF** from part (a)(i) for 1 mark. If large chips chosen scores **Max 1** mark only for rate of reaction is greater over first 8 minutes / more gas is made in first 8 minutes/in same time **ALLOW** small chips stop reacting at 16 mins but large chips stop at 20 mins
	(b)		small chips have greater surface area ✓ **BUT** small chips have greater surface area to volume ratio ✓✓ so more frequent/successful collisions ✓	3	3 x 1.2	**ALLOW** ORA

Question			Answer	Marks	AO element	Guidance
15	(a)		**Maximum three marks from:** idea that energy/heat/light or radiation from the Sun reaches the (surface of the) Earth✓ idea that energy/heat/light or radiation is absorbed by the (surface of the) Earth or warms up the (surface of the) Earth ✓ **BUT** energy/heat/light or radiation from the Sun is absorbed by the (surface of the) Earth or warms up the (surface of the) Earth ✓✓ idea that energy/heat or infrared (radiation) emitted by the (surface of the) Earth ✓ idea that some energy/heat or infrared (radiation) go back into space ✓ **AND at least one mark from:** idea that some energy/heat or infrared (radiation) is absorbed/trapped by greenhouse gas (molecules) in the (Earth's) atmosphere ✓ idea that energy/heat or infrared (radiation) from greenhouse gas (molecules) returns to Earth warming the (surface of the) Earth ✓	**4**	4 x 1.1	**IGNORE** rays throughout **IGNORE** bounce back/reflected/refracted/deflect throughout **ALLOW** named greenhouse gases **ALLOW** named greenhouse gases **DO NOT ALLOW** absorbed or emitted by ozone
	(b)		**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 evidence to support both Student A 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 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**	1.2 x 1 2.2 x 2 3.1a x 2 3.2b x 1	**AO1.1 Demonstrate knowledge and understanding of the Groups in 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 **AO3.1a Analyses information to interpret evidence from the table** <u>Evidence supporting Student A's conclusion</u> • melting points show a downward trend • similar reaction with water • all make hydrogen when react with water • increasing reactivity with water • formula of chlorides is the same • energy needed to remove one electron shows a downward trend • atomic radius or size of atom gets bigger <u>Evidence supporting Student B's conclusion</u> • 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 **AO3.2b Analyses information to draw conclusions based on the analysis** • Student A is correct as most evidence supports his viewpoint • The evidence suggests that the elements are in Group 1 • Student B is correct as not all the evidence supports the idea that the elements are in the same group

Question			Answer	Marks	AO element	Guidance
	(b)		$2\mathbf{Y} + 2H_2O \rightarrow 2\mathbf{Y}OH + H_2$ correct formulae ✓ balancing conditional on correct formulae ✓	**2**	2.2	**ALLOW** any correct multiple e.g. $4\mathbf{Y} + 4H_2O \rightarrow 4\mathbf{Y}OH + 2H_2$ **ALLOW** = for arrow **DO NOT ALLOW** 'and' or & for + **ALLOW** one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. $2\mathbf{Y} + 2H^2O \rightarrow 2\mathbf{Y}OH + h_2$ **ALLOW** Na for Y

Question			Answer	Marks	AO element	Guidance
17	(a)		idea that aluminium is **more** reactive than carbon / aluminium is high**er** in the reactivity series than carbon **ORA** ✓	**1**	1.1	**ALLOW** carbon can't displace aluminium/ carbon can't reduce aluminium oxide Assume 'it' refers to aluminium unless qualified
	(b)		to lower the melting point (of aluminium oxide) / dissolve the aluminium oxide ✓	**1**	1.1	
	(c)		$Al^{3+} + 3e^- \rightarrow Al$	**1**	2.1	**ALLOW** any correct multiple e.g. $2Al^{3+} + 6e^- \rightarrow 2Al$ **ALLOW** $Al^{3+} \rightarrow Al - 3e^-$ **ALLOW** = for arrow **DO NOT ALLOW** 'and' or & for +
	(d)		oxygen reacts with the carbon anodes ✓ making carbon dioxide ✓	**2**	2 x 1.1	
	(e)		$2Al_2O_3 \rightarrow 4Al + 3O_2$ correct formulae ✓ balancing conditional on correct formulae ✓	**2**	2 x 2.1	**ALLOW** any correct multiple e.g. $Al_2O_3 \rightarrow 2Al + 1½O_2$ **ALLOW** = for arrow **DO NOT ALLOW** 'and' or & for + **ALLOW** one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. $2Al_2O^3 \rightarrow 4aAl + 3O_2$

Question			Answer	Marks	AO element	Guidance
18	(a)		equilibrium moves to the right ✓ to remove added <u>oxygen</u> ✓	2	2 x 2.1	**ALLOW** more product/SO_3 made or favours forward reaction or increases yield/**ORA**
	(b)		equilibrium moves to the right ✓ 3 molecules/moles go to 2 molecules/moles (so reducing the pressure) ✓ **OR** **ALLOW** if discuss rate of attainment of equilibrium instead of position of equilibrium reaction attains equilibrium faster✓ as increasing pressure increases frequency/success of collisions✓	2	2 x 2.1	**ALLOW** more product/SO_3 made or favours forward reaction or increases yield/**ORA** **ALLOW** fewer molecules/moles on right hand side/**ORA**
	(c)		equilibrium moves to the left ✓ to favour the endothermic reaction/**forward** reaction is exothermic ✓ **OR** **ALLOW** if discuss rate of attainment of equilibrium instead of position of equilibrium reaction attains equilibrium faster✓ as increasing temperature increases frequency/success of collisions✓	2	2 x 2.1	**ALLOW** less product/SO_3 made or favours backward reaction or decreases yield or more SO_2 and/or O_2 made

Question			Answer	Marks	AO element	Guidance
	(d)		**FIRST CHECK ANSWER ON ANSWER LINE** **If answer is 24 (tonnes) award 3 marks** No of moles of sulfur dioxide = 48/64.1 or 0.75 (moles) ✓ Mass of sulfur = 0.75 x 32.1 = (24.075/24.037(4414977)/24.1) (tonnes) ✓ 24 (tonnes) (2 sig figs)✓	**3**	3 x 2.2	**ALLOW** correct calculations where candidates have converted tonnes to grams **ALLOW** ECF from marking point 1, for marking points 2 and 3.. **ALLOW** 24.075/24.037(4414977)/24.1 (correctly rounded) for 2 marks

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