

GCSE (9-1)

Combined Science A (Gateway)

Unit **J250/04**: Chemistry

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.

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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 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 $\pm \frac{1}{2}$ 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 (50cm ³) 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 smaller (than those in diesel)/ORA ✓	1	1.1	ALLOW (molecules in) petrol are smaller (number)/ shorter/fewer 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°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 (°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 <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> 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 <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> 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 <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>	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 <u>Supporting student A's conclusion</u> • melting points show a downward trend as Group is descended • similar reaction with water • formula of chlorides is the same <u>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 • 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 • <u>Student A</u> is correct as same number of electrons in outer shell • <u>Student A</u> is correct as most evidence supports his viewpoint • <u>Student B</u> is correct as not all the evidence supports the idea that the elements are in the same group

Question			Answer				Marks	AO element	Guidance	
17	(a)			Material A		Material B		2	2 x 2.2	All correct = 2 marks 2 or 3 correct = 1 mark 1 correct = 0 marks IGNORE units
			Energy used in MJ	Greenhouse gases made in g of CO ₂	Energy used in MJ	Greenhouse gases made in g of CO ₂				
		Extracting the raw materials	5.0	2.2	3.8	1.4				
		Manufacturing of the glass from the raw materials	0.4	0.3	0.4	0.1				
		Transporting the glass to the shops	1.5	1.0	3.1	2.2				
		Process W	2.0	0.6	5.0	1.7				
		Total	8.9	4.1	12.3	5.4				
	(b)		disposal (of the product) / end of life management / AW ✓				1	1.1	ALLOW recycling / reuse / melting IGNORE use of/selling product	
	(c)		idea that they could be heavier or more dense/ more energy or fuel used✓				1	2.1	ALLOW travels further IGNORE packaging/fragile IGNORE greenhouse gases	
	(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✓				2	2 x 3.2a	ALLOW data from table throughout ALLOW less global warming/climate change	

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/CO₂ 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 cm³ 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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