OCR
Oxford Cambridge and RSA

GCSE (9–1) H

Combined Science

(Chemistry) A (Gateway Science)

J250/09: Paper 9 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2019

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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**.

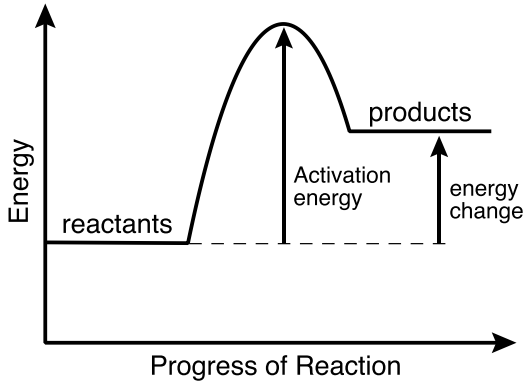
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

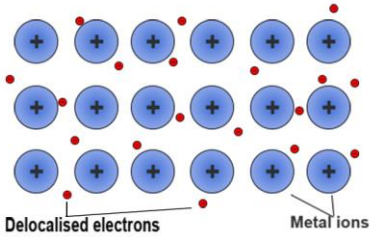
The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A:

	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.

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
1			C✓	1	1.1	
2			A✓	1	1.1	
3			A ✓	1	1.1	
4			D ✓	1	1.2	
5			C✓	1	1.1	
6			C ✓	1	1.1	
7			C✓	1	2.1	
8			B✓	1	2.2	
9			D✓	1	2.1	
10			A✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
11	(a)		Reaction Y ✓ **Any one from**: Temperature has dropped ✓ Energy / heat has been taken in / gained ✓ Temperature change is negative ✓	**2**	**3.2b** **2.1**	 **ALLOW** Final temp is lower than starting temp **IGNORE** any reference to exothermic reactions
	(b)		 Products line higher than reactants ✓ Energy change identified and shown as arrow facing upwards from reactants to products line ✓ Curve drawn to connect reactants and products line ✓ Activation energy correctly labelled between reactants line and highest point of curve and shown as an arrow facing upwards ✓	**4**	**2.1**	 **DO NOT ALLOW** activation energy or energy change with a double headed arrow **DO NOT ALLOW** activation energy arrow pointing downwards

Question			Answer	Marks	AO element	Guidance
	(c)		(Polystyrene cup) leads to less heat loss / ORA ✓ More **accurate** results / ORA ✓	**2**	**2.2**	**ALLOW** Polystyrene keeps heat in **ALLOW** Polystyrene cup is an insulator / does not conduct **IGNORE** Any references to precision
	(d)	(i)	Gain of oxygen / loss of electrons ✓	**1**	**1.1**	
	(d)	(ii)	 At least 6 spheres that are arranged in rows ✓ Spheres labelled as positive (metal) ions ✓ (Sea of / delocalised) electrons surrounding the ions ✓	**3**	**1.1**	**ALLOW** e / e^- as an electron without a label. All other symbols such as a negative sign must be labelled.

Question			Answer	Marks	AO element	Guidance
12*			*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)** Detailed description and explanation of mistakes that would mean the experiment would not give suitable data. Suggestions made to improve experiment including the correct processing of data. *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)** Description and explanation of some of the mistakes that would mean the experiment would not give suitable data. Suggestions made to improve experiment. This may include the correct processing of data. *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)** Limited description of the mistakes of the experiment. This may include limited explanation or suggestion(s) of improvements or the correct processing of data. *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 x 3.2a** **3 x 3.3b**	**AO3.2a Analyses the information to make judgements on chromatography method and R_f calculation** **Indicative science content that would not provide suitable data.** If line drawn in pen: • Pen/ink will run/dissolve/mix into solvent • Pen/ink will mix with spots/stop spots from being seen If solvent is at the same level: • Spots will run/smudge/dissolve/mix with solvent • Spots won't move up the paper If incorrect R_f equation is used: • R_f value will be > 1 / R_f value should be < 1 **Other indicative science content points** If line is not near the bottom: • There may not be enough distance for spots to move and be able to calculate Rf values accurately If beaker isn't covered: • Solvent will evaporate If spots are too large: • Separation won't be clear **AO3.3b Analyse information to suggest Improvements to chromatography method** • Line on plate should be drawn with pencil • Solvent should be under the pencil line instead of at the same level • R_f calculation is distance moved by solute divided by distance moved by solvent / R_f values should be X = 0.82, Y=0.68 and Z=0.54

Question			Answer	Marks	AO element	Guidance
13	(a)	(i)	Protons **and** neutrons ✓ 13 (protons) 14 (neutrons) ✓	2	1.1 2.1	**MP1** is for mention of protons and neutrons **DO NOT ALLOW** any reference to electrons in the nucleus. **IGNORE** mention of electrons in shells **MP2** depends on **MP1** **MP2** is for correct amounts of both sub atomic particle
		(ii)	Positive / + /+13 ✓	1	1.1	**DO NOT ALLOW** any number other than 13
		(iii)	Electrons ✓	1	1.1	
	(b)		(Student is not correct) – No mark Isotopes have same number of protons / isotopes are **atoms of the same element** ✓ (Same element /same number of protons) with a different number of neutrons ✓	2	2.1	**ALLOW** max score of 1 mark if the 'yes' box is ticked or neither box has been ticked. **ALLOW** P has a different number of protons (to *Al*) **IGNORE** any reference to electrons
	(c)	(i)	P_2O_5 ✓	1	2.2	
		(ii)	Aluminium oxide has ionic bonding **AND** phosphorous pentoxide has covalent bonding ✓ Ionic substances have high boiling points / simple covalent / covalent molecules have low boiling points ✓	2	3.2b 2.1	ALLOW 1 mark for identification of one correct bonding type linked to the correct explanation of boiling point.
	(d)	(i)	Moles of Mg 0.729/24.3 = 0.03 ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 108 award 3 marks** Moles of M $2 \times 0.03 = 0.06$ ✓ Relative atomic mass of M 6.476/0.06 = 107.93…. ✓ = 108 (3 SF) ✓	**3**	 **2.2** **2.2** **1.2**	**ALLOW ECF** from **(d)(i)** **ALLOW ECF** from incorrect moles M **ECF** if processing of data has given an incorrect value but expressed as 3SF
		(iii)	Silver ✓	**1**	**1.2**	**ALLOW ECF** from **(d)(ii)** **ALLOW ECF** for metal in periodic table closest to calculated relative atomic mass of M **DO NOT ALLOW** a non-metal element

Question			Answer	Marks	AO element	Guidance
14	(a)	(i)	Hydrogen / H^+ ✓ Sodium / Na^+ ✓	2	1.1	**ALLOW** answers in either order
		(ii)	Hydrogen / H_2 (gas) is formed ✓ Because hydrogen (ions) / H^+ are less reactive than sodium (ions) / Na^+ / ORA ✓	2	1.1	**DO NOT ALLOW** H is formed **ALLOW** lower in reactivity series
	(b)		$Mg^{2+} + 2e^- \rightarrow Mg$ Formulae ✓ Balancing ✓	2	2.1	**ALLOW** any correct multiple **DO NOT ALLOW** and / & instead of '+' balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae eg Mg2+, Mg^0 or MG **ALLOW** $Mg^{2+} \rightarrow Mg - 2e^-$

Question			Answer	Marks	AO element	Guidance
15	(a)		Type: covalent ✓ Number: 4 ✓	2	1.1	Mark independently
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.44 x 10^{23} award 4 marks** Atomic weight = (6x12) + (1x12) = 84g ✓ Moles of hex-1-exe = 20 ÷ 84 = 0.24 / 0.238 / 0.2381 ✓ Number of molecules = 0.24 x (6.02x10^{23}) = 1.4448 x 10^{23} ✓ = 1.44 x 10^{23} (3sf) ✓	4	3 x 2.2 1.2	**ALLOW** correct answer to 3 sig figs from moles of hex-1-ene (0.24 / 0.238 / 0.2381) [0.238 gives 1.43 x 10^{23}; 0.2381 gives 1.43 x 10^{23}) **ALLOW ECF** from incorrect atomic weight **ALLOW ECF** from incorrect number of moles **ECF** if processing of data has given an incorrect value but expressed as 3SF
		(ii)	Not enough oxygen / oxygen was a limiting reactant ✓	1	3.2b	**ALLOW** idea that **incomplete** combustion occurred

Question			Answer	Marks	AO element	Guidance
16	(a)		25(cm^3) ✓	1	3.1a	
	(b)		(As more acid is added) pH decreases ✓ Gradual change at the start / sharp (change) in pH when 25cm^3 acid added half way through / gradual change at the end AW ✓	2	3.1a	**IGNORE** mixture / solution becomes more acidic or less alkaline.
	(c)		H^+ / hydrogen **ion** (concentration) increases ✓ (So) pH decreases ✓	2	1.1	Statement must be comparative. MP2 dependent on MP1

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