

**GCSE (9–1)**

**Combined Science**

**(Chemistry) A (Gateway Science)**

**J250/03: Paper 3 (Foundation 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.

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Annotations available in RM Assessor3

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).

<b>Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be accepted
( )	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	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:

	<b>Assessment Objective</b>
<b>AO1</b>	<b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
<b>AO2</b>	<b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
<b>AO3</b>	<b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b>
<b>AO3.1</b>	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
<b>AO3.2</b>	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.
<b>AO3.3</b>	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.

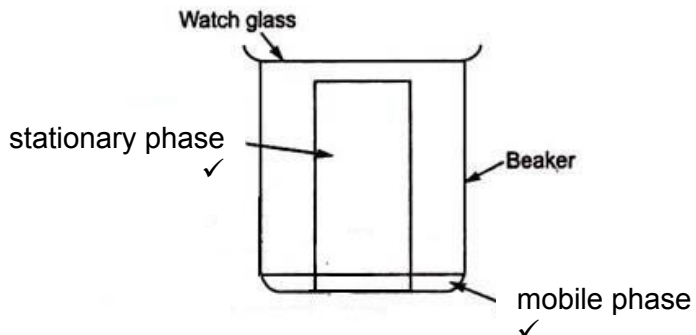
Question			Answer	Marks	AO element	Guidance
1			B ✓	1	2.1	
2			D ✓	1	1.1	
3			D ✓	1	1.2	
4			C ✓	1	2.2	
5			C ✓	1	1.1	
6			C ✓	1	2.1	
7			A ✓	1	2.2	
8			D ✓	1	2.2	
9			D ✓	1	2.2	
10			C ✓	1	1.1	

Question		Answer	Marks	AO element	Guidance
11	(a)	Proton: +1 ✓ Electron: -1 ✓	2	1.1	<b>ALLOW</b> 1+ / positive / + <b>ALLOW</b> 1- / negative / -
	(b) (i)	(Relative atomic mass =) 23.0 / 23 ✓ (Protons = ) 11 ✓ (Electrons = ) 11 ✓	3	2.1 2.2 2.2	
	(ii)	<b>Any one from:</b> Loses 1 electron ✓	1	1.1	<b>ALLOW</b> loses electrons <b>ALLOW</b> it becomes positively charged
	(c)	(group number is the) number of electrons in <b>outer shell</b> ✓	1	1.1	
	(d)	<b>Type of bonding:</b> metallic ✓  <b>Reason:</b> <b>Any one from:</b> It conducts electricity ✓ It has a high melting point ✓ It forms oxides with oxygen ✓	2	3.2b  2.1	<b>ALLOW</b> <u>giant</u> covalent  Mark for reason dependent on correct type of bonding



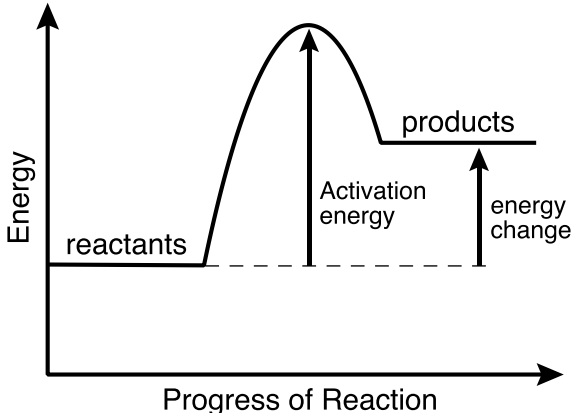
Question			Answer	Marks	AO element	Guidance
12	(a)	(i)	50 (°C) ✓	1	3.2b	<b>DO NOT ALLOW</b> any other value
		(ii)	Liquid ✓	1	3.2b	
	(b)		Gas ✓	1	1.1	
	(c)	(i)	X (no mark)  <b>Any one from:</b> because it is a simple covalent compound ✓  it has a lower <b>melting</b> point (than Y) ✓	1	2.1	<b>DO NOT ALLOW</b> the mark if Y is chosen  <b>ALLOW</b> cannot be Y since ionic compounds <b>are made of ions</b> /not molecules
	(c)	(ii)	<b>Any two from:</b>  <b>Strength of forces:</b> X has weak forces AND Y has strong forces / X has weaker forces (than Y) / Y has stronger forces (than X) ✓  <b>Naming forces:</b> X has intermolecular forces (between molecules) / Y has electrostatic forces (between ions) ✓  <b>Energy comparison:</b> X requires LESS energy to melt or overcome forces / ORA ✓	2	2.1	<b>AW</b> candidates can use the term 'covalent compound' to mean X / 'ionic compound' to mean Y throughout  <b>ALLOW</b> 2 marks for X has weak intermolecular forces / Y has strong electrostatic forces  <b>ALLOW</b> bonds for forces throughout

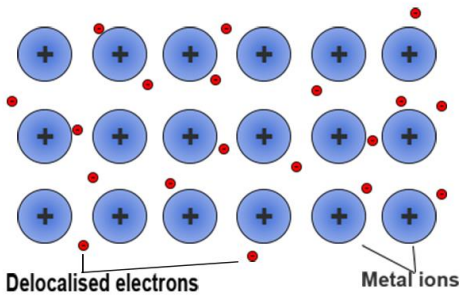
Question			Answer	Marks	AO element	Guidance
13	(a)	(i)	B ✓	1	3.2b	
		(ii)	Any number(s) < 7 ✓	1	1.1	
		(iii)	<b>Any two from:</b> Universal indicator ✓ Litmus paper ✓ pH probe /meter ✓	2	1.2	<b>ALLOW</b> other indicators e.g. methyl orange, phenolphthalein  <b>ALLOW</b> add a metal / correctly named metal to see if it fizzes / AW
	(b)		pH decreases as volume of acid increases / ORA ✓	1	3.1a	<b>ALLOW</b> more acid/more solution instead of volume of acid  <b>ALLOW</b> the more acid, the more neutral it becomes
	(c)		OH <sup>-</sup> ✓	1	1.1	<b>ALLOW</b> correct answer ticked, circled or underlined
	(d)		H <sub>2</sub> SO <sub>4</sub> + 2 NaOH → Na <sub>2</sub> SO <sub>4</sub> + 2 H <sub>2</sub> O ✓	1	2.2	<b>BOTH</b> numbers required for the mark <b>ALLOW</b> correct multiples

Question			Answer	Marks	AO element	Guidance
14	(a)	(i)	$C_7H_6O_3$ ✓	1	2.2	<b>DO NOT ALLOW</b> $C_7H_6O_3$ / $C^7H^6O^3$  Atoms may be in any order  All atoms of the same element must be together
	(b)	(i)	Contains only one type of (atom / element or) compound / molecule ✓	1	1.1	<b>ALLOW</b> not a <b>mixture</b> <b>ALLOW</b> contains only aspirin (molecules)
		(ii)	B ✓	1	3.2a	
	(c)			2	2.2	
	(d)*		<p><i>Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question</i></p> <p><b>Level 3 (5–6 marks)</b> Detailed description and explanation of mistakes including an explanation of the error in the <math>R_f</math> equation. <b>AND</b> Detailed improvements suggested.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p>	6	3.2a x 3 3.3b x 3	<b>AO3.2a Analyses the information to make judgements on chromatography method</b>  <b>1. If line drawn in pen:</b> <ul style="list-style-type: none"> <li>• Pen/ink will run/smudge/dissolve/bleed/mix into solvent</li> <li>• Pen/ink will mix with spots/stop spots from being seen</li> </ul>

Question	Answer	Marks	AO element	Guidance
	<p><b>Level 2 (3–4 marks)</b> Description and explanation of some of the mistakes. Some suggestions made to improve experiment. <b>OR</b> Detailed description and explanation of the mistakes in the method. <b>OR</b> An explanation of the error in the <math>R_f</math> equation.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–2 marks)</b> Limited description of the mistakes in the experiment. This may include suggestion(s) of improvements or a limited explanation.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p><b>0 marks</b> <i>No response or no response worthy of credit.</i></p>			<p><b>2. If solvent is at the same level:</b></p> <ul style="list-style-type: none"> <li>• Spots will run/smudge/dissolve/mix with solvent</li> <li>• Spots won't move up the paper</li> </ul> <p><b>3. <math>R_f</math> equation is incorrect</b></p> <p><b>4. If paper is standing rather than hanging:</b></p> <ul style="list-style-type: none"> <li>• It may bend or fall against the sides of the beaker</li> </ul> <p><b>AO3.3b Analyses the information to suggest improvements to chromatography method</b></p> <ul style="list-style-type: none"> <li>• Line on paper should be drawn with pencil</li> <li>• Solvent should be under the pencil line instead of at the same level</li> <li>• <math>R_f</math> calculation is incorrect as the equation is the wrong way round</li> <li>• Hang the paper</li> </ul>

Question			Answer	Marks	AO element	Guidance
15	(a)		Filter/filtration	1	1.2	
	(b)	(i)	<b>FIRST CHECK ANSWER ON ANSWER LINE</b> <b>If answer = 24.3 award 3 marks</b>  $= (63.5 \times 8.10) \div 21.2 \checkmark$  $= 24.26 \checkmark$  $= 24.3 \text{ (3 sig. figs)} \checkmark$	3	2.2  2.2  1.2	<b>ALLOW</b> 2 marks for 24.26 up to calculator value  Calculator value is 24.26179245. Incorrect rounding maximum 2 marks e.g. 24.2  <b>ECF</b> if processing of data has given an incorrect value but expressed as 3SF
		(ii)	Mg / Magnesium $\checkmark$	1	1.2	<b>ALLOW ECF</b> from (b)(i)

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

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

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