

GCSE (9-1)

Chemistry A

(Gateway Science)

J248/01: Paper 1 (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 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.

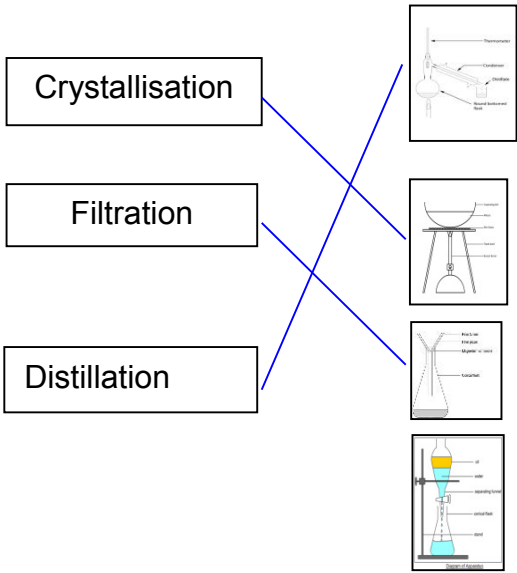
The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A:

	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.

SECTION A

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	1.1	
2	B	1	1.1	
3	A	1	1.1	
4	C	1	2.1	
5	B	1	2.2	
6	B	1	2.1	
7	C	1	2.1	
8	B	1	2.1	
9	B	1	2.1	
10	D	1	1.1	
11	D	1	1.1	
12	A	1	2.1	
13	C	1	2.1	
14	B	1	2.2	
15	C	1	2.1	
	Total	15		

Question			Answer	Marks	AO element	Guidance
16	(a)		 <p>If more than one line drawn to apparatus DO NOT award the mark.</p>	3	1.2	
	(b)		Use a magnet ✓	1	2.2	ALLOW dissolve sulfur in solvent/xylene and filter ALLOW sieve
	(c)		<p>A new substance is made ✓</p> <p>The change is irreversible (by physical means) / impossible to reverse (by physical means) / difficult to reverse ✓</p>	2	1.1	<p>ALLOW products look different to reactants/products are different to reactants/only one substance made/colour change</p> <p>ALLOW product has a fixed composition/formula OR mixture doesn't</p> <p>ALLOW there is an energy/temperature change/exothermic/endothermic</p> <p>ALLOW properties of product are different from</p>

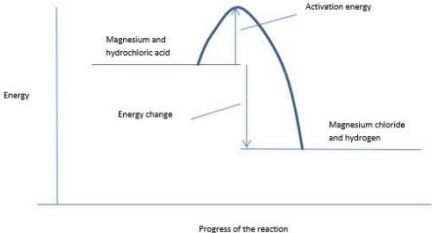
Question			Answer	Marks	AO element	Guidance
						reactants
	(d)	(i)	(particles) regular/in rows✓ (particles) close together✓	2	1.1	ignore fixed allow touching/all touching/little space between or no space between/tightly packed ALLOW compact both marks can be gained from a diagram
		(ii)	Vibrating (about a fixed position) ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	900 (°C) ✓	1	3.3a	
		(ii)	(compound X) consists of one type of particle/one compound/element/substance	1	1.1	ALLOW no other substance mixed with it
		(ii)	A pure substance melts at a specific temperature / the line is horizontal / has a single melting temperature ✓	1	2.1	ALLOW A mixture melts over a range of temperatures / the line would not be horizontal IGNORE boiling point
	(b)*		<p><i>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</i></p> <p>Level 3 (5–6 marks) Describes the bonding in compound X in detail. AND Links explanation to at least two of the properties to the bonding in compound X.</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> <p>Level 2 (3–4 marks) Describes the bonding in compound X. AND Links explanation to one of the properties to the bonding in compound X.</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>Level 1 (1–2 marks) Attempts to describe the bonding in compound X. OR</p>	6	1.1 x2 2.1 x2 3.2a x2	<p>AO1.1 Knowledge and understanding of ionic bonding</p> <ul style="list-style-type: none"> • Ions cannot move in a solid so will not conduct electricity • No delocalised electrons, cannot conduct as a solid • Ions can move in a liquid, so it will conduct electricity when molten • Bonding is very strong and takes a lot of energy to break, so it will have a high melting point • Ionic bonds are strong electrostatic forces of attraction between oppositely charged ions <p>AO2.1 Application of knowledge and understanding of properties linked to the bonding in a compound</p> <ul style="list-style-type: none"> • Compound X has positive and negative ions. • Compound X contains ions • Compound X does not have mobile electrons <p>AO3.2a Analysis of information and ideas to make judgements</p> <ul style="list-style-type: none"> • The bonding in compound X is ionic • The bonding in compound X is very strong • The bonding cannot be metallic • The bonding cannot be covalent

Question			Answer	Marks	AO element	Guidance
			<p>Attempts to link explanation to one of the properties to the bonding.</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>0 marks <i>No response or no response worthy of credit.</i></p>			

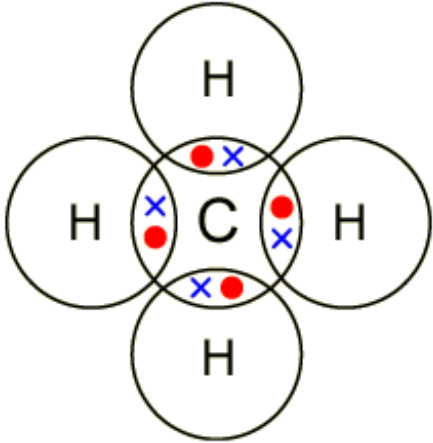
Question			Answer	Marks	AO element	Guidance
18	(a)	(i)	Red and Yellow ✓	1	3.1a	BOTH needed for the mark
		(ii)	Y ✓ All paints are soluble (in Y) / ORA ✓	2	3.1b 3.2b	ALLOW dissolves all 3 colours/forms (clear) solutions
		(iii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.79 award 3 marks $R_f = 41(\text{mm}) \div 52(\text{mm}) / 4.1(\text{cm}) \div 5.2(\text{cm})$ ✓ $= 0.788 \dots\dots$ ✓ $= 0.79$ (2 sig figs) ✓	3	2.2 x2 1.2	
	(b)		No (no mark) All the sample paints match the paint in the 1973 painting / chromatogram is the same as the 1973 chromatogram ✓	1	3.2b	ALLOW The blue paint was different in 1849 / blue paint has different R_f to the blue paint used in 1849 / blue paint pure in 1849 / blue paint not pure in sample/it doesn't match 1849

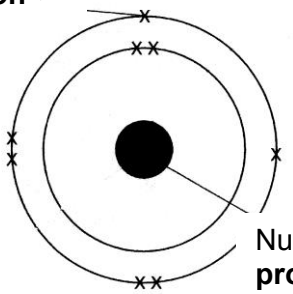
Question			Answer	Marks	AO element	Guidance
19	(a)	(i)	Exothermic ✓	1	1.1	
		(ii)	Mg + 2HCl → MgCl ₂ + H ₂ Formulae ✓ Balancing ✓	2	2.1 2.2	ALLOW any correct multiple, including fractions ALLOW = / ⇒ instead of → NOT and / & instead of + balancing mark is dependent on the correct formulae but ALLOW 1 mark (M2) for a balanced equation with a minor error in subscripts / formulae eg MG + 2HCl → MgCl ₂ + H ₂
		(iii)	Aluminium chloride ✓	1	2.2	ALLOW correct formula AlCl ₃
	(b)	(i)	7.6 ✓	1	3.2b	
		(ii)	error taking the temperature (at start or at end) ✓	1	3.2a	ALLOW used more/less metal / used more/less acid ALLOW reaction did not finish IGNORE faulty thermometer
		(iii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 10.3 (°C) award 2 marks (10.3 + 10.5 + 10.2) ÷ 3 = 10.3333.... (°C) ✓ = 10.3 (°C) (1 decimal place) ✓	2	2.2	

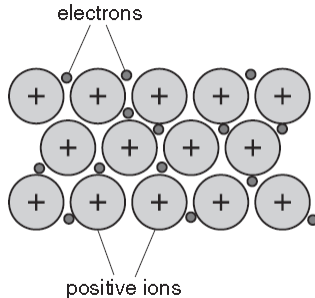
Question			Answer	Marks	AO element	Guidance
	(c)	(i)	<p><u>Improvement</u> Any one from: Put a lid on the polystyrene cup / Put insulating material around the polystyrene cup / Use a digital thermometer ✓ Use a data logger ✓</p> <p>AND <u>Reason</u> Any one from: Stops/reduces heat loss (through evaporation) / Prevents/reduces heat loss (from the polystyrene cup) / (Digital thermometer) is easier to read / (Digital thermometer) gives more accurate/precise readings ✓ (data logger) gives continuous data so can get max T</p>	2	<p>3.3b</p> <p>2.2</p>	<p>Reason must be linked to the Improvement to be awarded the second mark</p> <p>ALLOW add same amount of metal / acid/measure mass metal / measure volume acid</p> <p>..... so can compare results</p> <p>ALLOW more metal / acid</p> <p>..... gives larger T change / errors are less significant</p>
		(ii)	<p>Any two from: Use different types of acids ✓ Use a wider range of metals ✓ Change the mass of metal used ✓ Change the volume of acid used ✓</p>	2	3.3a	<p>ALLOW more reactive/less reactive metals</p> <p>IGNORE concentration</p>
	(d)			3		<p>ALLOW ECF if endothermic is given as answer in (a)(i)</p>

Question			Answer	Marks	AO element	Guidance
			Reactants above and to the left of products and both labelled in words or formulae ✓		1.2	ALLOW label as just 'products'
			Energy change downward arrow and labelled ✓		2.2 x2	ALLOW double headed labelled $-\Delta H$
			Activation energy upward arrow and labelled ✓			DO NOT ALLOW activation energy with a double headed arrow DO NOT ALLOW activation energy arrow pointing downwards

Question			Answer	Marks	AO element	Guidance
20	(a)	(i)	Buckminsterfullerene / bucky ball ✓	1	1.1	ALLOW C ₆₀ IGNORE fullerene
		(ii)	Has many atoms joined together (by covalent bonds) ✓ Arranged in a repeating pattern ✓	2	1.1	ALLOW all atoms joined together / each/every C atom joined together DO NOT ALLOW imf
	(b)	(i)	Many strong (covalent) bonds ✓ A lot of energy needed to break the bonds ✓	2	1.1	ALLOW each/every C bonded to 4 C atoms (ie network idea) / many bonds / network of bonds / bonds throughout structure ✓ strong (covalent) bonds ✓ DO NOT ALLOW IMF/ionic
		(ii)	Layers slide over each other / weak forces between the layers ✓	1	1.1	IGNORE IMF
	(c)		Any two from: Conducts electricity because touchscreens need to be able to conduct electricity ✓ High strength so screen does not break when dropped/ so doesn't wear off / rub off / crack from pressure of fingers ✓ Transparent so can see light through the display ✓	2	3.2a	ALLOW doesn't break easily ALLOW can see work/can see through it

Question			Answer	Marks	AO element	Guidance
	(d)	(i)		2	2.2	<p>ALLOW all dots or all crosses</p> <p>Inner shell electrons on carbon not needed</p> <p>ALLOW 1 mark only for correct bonding pairs and a non bonding electron on H</p>
		(ii)	<p>Weak forces ✓</p> <p>Between molecules ✓</p>	2	2.1	<p>DO NOT ALLOW mention of intramolecular bonding</p> <p>IGNORE weak bonds alone</p> <p>DO NOT ALLOW weak covalent bonds</p> <p>weak intermolecular forces/bonds ✓✓</p>

Question			Answer	Marks	AO element	Guidance
21	(a)	(i)	<p>electron ✓</p>  <p>Nucleus containing protons and neutrons ✓</p> <p>(Need both for the mark)</p>	2	1.1	ALLOW either order
		(ii)	Has equal numbers of (positive) protons and (negative) electrons ✓	1	2.1	q asks for particles IGNORE protons cancel electrons
	(b)		<p>Isotopes have same number of protons (and electrons) ✓</p> <p>Isotopes have different numbers of neutrons ✓</p>	2	1.1	<p>ALLOW same proton number/same atomic number</p> <p>ALLOW different mass number/number of nucleons/atomic mass</p> <p>DO NOT ALLOW different RAM/M_r</p> <p>ALLOW 1 mark for same protons and different neutrons</p>

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	Positive (metal) ions / cations ✓ Surrounded by sea of or delocalised electrons ✓	2	1.1	<p>Any reference to ionic or covalent bonding or IMF scores 0</p> <p>ALLOW a labelled diagram</p>  <p>If diagram must be at least one electron in the body of the ions Diagram must show close packed metal ions, in a regular arrangement ALLOW - / e / e⁻ / dots for electrons ALLOW Circles with + or circles labelled ions IGNORE free electrons</p> <p>If e or e⁻ used don't need labelling</p>
		(ii)	Idea that layers or rows or sheets (of particles) slide over each other ✓	1	1.1	<p>IGNORE layers can bend IGNORE IMF</p>
		(iii)	Has electrons ✓ That can move / that can carry the charge ✓ BUT Delocalised electrons scores 2 marks	2	1.1	<p>DO NOT ALLOW free ions – scores 0</p> <p>IGNORE free (electrons) for idea of movement</p>

Question			Answer		Marks	AO element	Guidance
	(b)			<p>Low density and idea that aircraft is lightweight / isn't too heavy to fly / less weight to carry / AW ✓</p> <p>High strength and idea that aircraft is less likely to be damaged ✓</p>	2	3.2b	<p>DO NOT ALLOW light / lighter for low density but ALLOW so aircraft is light or lighter</p> <p>Answers must give property and explanation for marks BUT ALLOW 1 mark for low density and high strength / strongest if no or only one explanation given</p>
	(c)		(i)	(Percentage of lithium =) $(2 \div 10) \times 100 = 20(\%)$ ✓	1	3.1a	
			(ii)	<p>Idea that alloy B is only 2.2% lithium /</p> <p>Idea that alloy B is 2.2% lithium but the diagram has 20% lithium /</p> <p>Idea that the % of lithium in the alloy is much smaller than in the diagram /</p> <p>there should be 100 aluminium atoms (and 2 lithium atoms) ✓</p>	1	3.2a	<p>ALLOW ECF from incorrect percentage in (c)(i) ALLOW should be more Al atoms / 17.8% too large</p> <p>IGNORE references to the relative sizes of the atoms</p>

Question			Answer	Marks	AO element	Guidance
23	(a)		<p>Could be breathed in /</p> <p>Idea of absorbed by skin /</p> <p>Idea of absorbed into bloodstream /</p> <p>Take a long time to break down in the environment ✓</p>	1	2.1	<p>ALLOW cannot see so may leave (areas of) skin unprotected</p> <p>ALLOW idea that we don't know the long term risks</p> <p>IGNORE idea that they are not fully understood / there could be side effects / idea that they may react with skin / harmful to humans</p>
	(b)		<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.12 OR 0.12:1 or 1:8.3 award 4 marks</p> <p>Surface area = $6 \times 50^2 = 15000$ ✓</p> <p>Volume = $50^3 = 125000$ ✓</p> <p>Surface area / volume ratio $= 15000 \div 125000$ ✓</p> <p>$= 0.12$ or $0.12:1$ or $1:8.3$ ✓</p>	4	<p>3 x 2.2</p> <p>1.2</p>	<p>Units not needed</p> <p>ALLOW surface area = $1.5 \times 10^4 \text{ nm}^2$</p> <p>ALLOW volume = $1.25 \times 10^5 \text{ nm}^3$</p> <p>ALLOW ECF from incorrect surface area and/or volume</p> <p>ALLOW any ratio that simplifies to 0.12:1 eg 3:25 or 1.5:12.5 for 4 marks</p> <p>DO NOT ALLOW ratio wrong way round eg 1:0.12</p>
	(c)	(i)	<p>Nanoparticles have diameter between 1 nm – 100 nm / idea that (diameter of) DNA is more than 1 nm but less than 100 nm ✓</p> <p>Water (molecule) is too small / 0.27 nm is less than 1 nm / idea that 0.27 nm is not in range 1 nm – 100 nm ✓</p>	2	1.1	<p>ALLOW has at least one dimension on the nanoscale</p>
		(ii)	<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 3100 award 2 marks</p> <p>$100000 \div 32$ ✓</p> <p>$= 3100$ (2 significant figures) ✓</p>	2	2.2	<p>ALLOW 3125 for 1 mark</p> <p>ALLOW 0.00032 for 1 mark (correct sig figs from incorrect working out, ie $32 \div 100000$)</p>

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