OCR
Oxford Cambridge and RSA

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# 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.

Annotations available in RM Assessor

| Annotation | Meaning |
|---|---|
|  | Correct response |
|  | Incorrect response |
|  | 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.

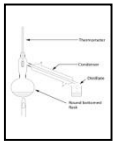
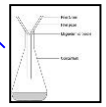
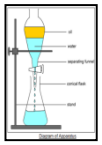
The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A:

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

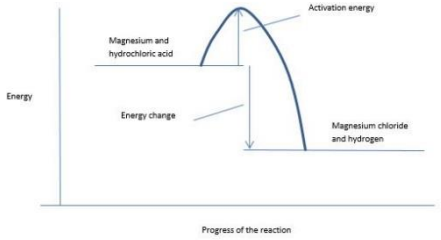
| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | | | | | reactants |
| | **(d)** | **(i)** | (particles) regular/in rows✓<br><br>(particles) close together✓ | **2** | **1.1** | **ignore** fixed<br><br>**allow** touching/all touching/little space between or no space between/tightly packed<br>**ALLOW** compact<br><br>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 ($^0$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<br>**IGNORE** boiling point |
| | (b)* | | *Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*<br><br>**Level 3 (5–6 marks)**<br>Describes the bonding in compound X in detail.<br>**AND**<br>Links explanation to at least two of the properties to the bonding in compound X.<br><br>*There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*<br><br>**Level 2 (3–4 marks)**<br>Describes the bonding in compound X.<br>**AND**<br>Links explanation to one of the properties to the bonding in compound X.<br><br>*There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*<br><br>**Level 1 (1–2 marks)**<br>Attempts to describe the bonding in compound X.<br>**OR** | 6 | 1.1 x2<br>2.1 x2<br>3.2a x2 | **AO1.1 Knowledge and understanding of ionic bonding**<br>• Ions cannot move in a solid so will not conduct electricity<br>• No delocalised electrons, cannot conduct as a solid<br>• Ions can move in a liquid, so it will conduct electricity when molten<br>• Bonding is very strong and takes a lot of energy to break, so it will have a high melting point<br>• Ionic bonds are strong electrostatic forces of attraction between oppositely charged ions<br><br>**AO2.1 Application of knowledge and understanding of properties linked to the bonding in a compound**<br>• Compound X has positive and negative ions.<br>• Compound X contains ions<br>• Compound X does not have mobile electrons<br><br>**AO3.2a Analysis of information and ideas to make judgements**<br>• The bonding in compound X is ionic<br>• The bonding in compound X is very strong<br>• The bonding cannot be metallic<br>• The bonding cannot be covalent |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | | Attempts to link explanation to one of the properties to the bonding.<br><br>*There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.*<br><br>**0 marks**<br>*No response or no response worthy of credit.* | | | |

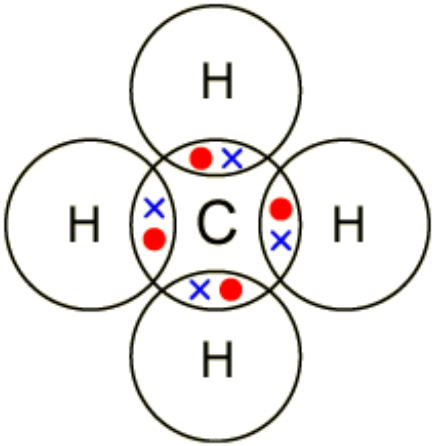
| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 18 | (a) | (i) | Red and Yellow ✓ | 1 | 3.1a | **BOTH** needed for the mark |
| | | (ii) | Y ✓<br><br>All paints are soluble (in Y) / ORA ✓ | 2 | 3.1b<br><br>3.2b | <br><br>**ALLOW** dissolves all 3 colours/forms (clear) solutions |
| | | (iii) | **FIRST CHECK THE ANSWER ON ANSWER LINE**<br>**If answer = 0.79 award 3 marks**<br><br>$R_f$ = 41(mm) ÷ 52(mm) / 4.1(cm) ÷ 5.2(cm) ✓<br><br>= 0.788 ….. ✓<br><br>= 0.79 (2 sig figs) ✓ | 3 | <br><br>2.2 x2<br><br><br>1.2 | |
| | (b) | | No (no mark)<br><br>All the sample paints match the paint in the 1973 painting / chromatogram is the same as the 1973 chromatogram ✓ | 1 | 3.2b | <br><br>**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 |

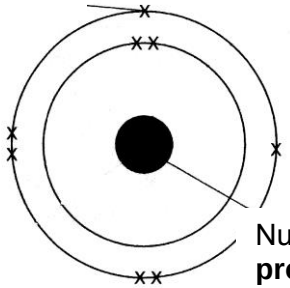
| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 19 | (a) | (i) | Exothermic ✓ | 1 | 1.1 | |
| | | (ii) | $Mg + \mathbf{2}HCl \rightarrow MgCl_2 + H_2$<br><br>Formulae ✓<br>Balancing ✓ | 2 | 2.1<br>2.2 | **ALLOW** any correct multiple, including fractions<br>**ALLOW** = / ⇌ instead of →<br>**NOT** and / & instead of +<br><br>balancing mark is dependent on the correct formulae but<br>**ALLOW** 1 mark (M2) for a balanced equation with a minor error in subscripts / formulae<br>eg MG + **2**HCl → $MgCl_2 + H_2$ |
| | | (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<br>**ALLOW** reaction did not finish<br>**IGNORE** faulty thermometer |
| | | (iii) | **FIRST CHECK THE ANSWER ON ANSWER LINE**<br>**If answer = 10.3 (°C) award 2 marks**<br><br>(10.3 + 10.5 + 10.2) ÷ 3 = 10.3333…. (°C) ✓<br>= 10.3 (°C) (1 decimal place) ✓ | 2 | 2.2 | |

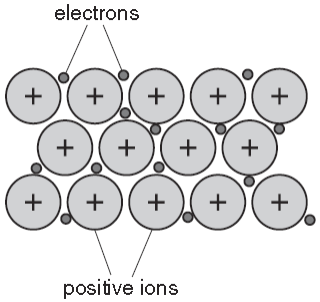
| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | (c) | (i) | **<u>Improvement</u>**<br>**Any one from:**<br>Put a lid on the polystyrene cup /<br>Put insulating material around the polystyrene cup /<br>Use a digital thermometer ✓<br>Use a data logger ✓<br><br>**AND**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

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

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 20 | (a) | (i) | Buckminsterfullerene / bucky ball ✓ | 1 | 1.1 | **ALLOW** $C_{60}$<br>**IGNORE** fullerene |
| | | (ii) | Has many atoms joined together (by covalent bonds) ✓<br><br>Arranged in a repeating pattern ✓ | 2 | 1.1 | **ALLOW** all atoms joined together / each/every C atom joined together<br>**DO NOT ALLOW** imf |
| | (b) | (i) | **Many** strong (covalent) bonds ✓<br><br>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 ✓<br><br>strong (covalent ) bonds ✓<br>**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:**<br>Conducts electricity because touchscreens need to be able to conduct electricity ✓<br><br>High strength so screen does not break when dropped/ so doesn't wear off / rub off / crack from pressure of fingers ✓<br><br>Transparent so can see light through the display ✓ | 2 | 3.2a | <br><br><br>**ALLOW** doesn't break easily<br><br>**ALLOW** can see work/can see through it |

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

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

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

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

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

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