OCR
Oxford Cambridge and RSA

# GCSE (9–1) F

# Combined Science B (Twenty First Century Science)

**J260/02:** Chemistry (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 B:

| | 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. |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th>True</th><th>False</th></tr>
<tr><td>They all have 2 electrons in their first shell.</td><td>✓</td><td></td></tr>
<tr><td>They all have 1 electron in their outer shell.</td><td>✓</td><td></td></tr>
<tr><td>They all have the same number of electrons</td><td></td><td>✓</td></tr>
<tr><td>They all have the same number of electron shells</td><td></td><td>✓</td></tr>
</table>
</td><td>2</td><td>1.1</td><td>4 correct = two marks<br>3 or 2 correct = one mark<br>1 or 0 correct = zero marks</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><td>They have a small number of electrons in their outer shell.</td><td>✓</td></tr>
<tr><td>They do not contain electrons.</td><td></td></tr>
<tr><td>They lose electrons easily.</td><td>✓</td></tr>
<tr><td>They form covalent bonds by gaining electrons.</td><td></td></tr>
</table>
</td><td>2</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Faster fizzing down the group/potassium catches fire ✓<br><br>more reactive down the group ✓</td><td>2</td><td>3.1a</td><td>IGNORE references to energy<br><br>ALLOW ‘potassium is most reactive / lithium is least reactive’</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Fizzing<br>Indicator ..<br><br>hydrogen ✓<br>oxygen<br>water<br>hydroxide ions ✓</td><td>2</td><td>1.2</td><td>DO NOT ALLOW if more than one line drawn from a box on the left hand side.</td></tr>
</table>

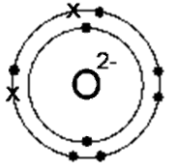
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>heat ✓<br>increases ✓<br>water ✓<br>evaporate ✓</td><td>3</td><td>1.1</td><td>4 correct = three marks<br>3 correct = two marks<br>2 correct = one mark<br>1 or 0 correct = zero marks</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><table><tr><td>(B)</td><td>F</td><td>A</td><td>C</td><td>D</td><td>(E)</td></tr></table><br>F before A ✓<br>A before C ✓<br>C before D ✓</td><td>3</td><td>2.2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>heat until crystallisation point/partially evaporate water ✓<br><br>leave to cool/ leave to crystallise/leave until crystals form ✓</td><td>2</td><td>3.3a</td><td>ALLOW heat more gently/ heat slowly/leave to stand on a window ledge/leave to stand overnight/ use a smaller flame.<br><br>DO NOT ALLOW heat to dryness.</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>8.4(g) ✓</td><td>1</td><td>2.1</td><td></td></tr>
<tr><td></td><td></td><td>(iv)</td><td>FIRST CHECK THE ANSWER ON ANSWER LINE<br>If answer = 84 award 2 marks<br><br>(8.4 ÷ 10) × 100 ✓<br>84 ✓</td><td>2</td><td>2.2</td><td>ALLOW ECF from 2(b)(iii)</td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 3 | (a) | | Steel (iron alloy) **AND** aluminium (alloy) ✓ | 1 | 1.1 | Answers can be in either order |
| | (b) | | composite ✓ | 1 | 1.1 | |
| | (c) | | **FIRST CHECK THE ANSWER ON ANSWER LINE**<br>**If answer = 1.5 (g/cm$^3$) award 2 marks**<br><br>(12.0 ÷ 8.0) ✓<br>= 1.5 (g/cm$^3$)✓ | 2 | 2.2 | |

| Question | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|
| (d)* | Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question.<br><br>**Level 3 (5–6 marks)**<br>Gives an advantage **AND** disadvantage for steel and aluminium **AND**<br>Chooses graphite as the most suitable material to use with a reasoned explanation.<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>Gives an advantage **AND** disadvantage of two of the materials **AND** chooses graphite as the most suitable material to use.<br>**OR**<br>Comments on **all** the materials **AND** chooses graphite as the most suitable material to use.<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>Gives an advantage **AND** disadvantage of one of the materials.<br>**OR**<br>Comments on most of the materials.<br>**OR**<br>Chooses graphite with a simple reason<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.* | **6** | **5x3.1b**<br>**1x3.2a** | **AO3.1b – Analyse information and ideas to evaluate data to identify which material is the most suitable.**<br><br>**Advantages**<br>• steel is the stiffest<br>• steel is second strongest<br>• aluminium less dense than steel<br>• graphite is strongest<br>• graphite is less dense<br>• graphite is less stiff than steel<br><br>**Disadvantages**<br>• aluminium least stiff<br>• steel is heavy<br>• aluminium heavier than graphite<br><br>Uses data from the table to support their answer.<br><br>**AO3.2a – Analyse information and ideas to make a judgement and choose the most suitable material.**<br>• Chooses graphite, supported by reasoning identified above<br><br>**IGNORE** references to PVC |

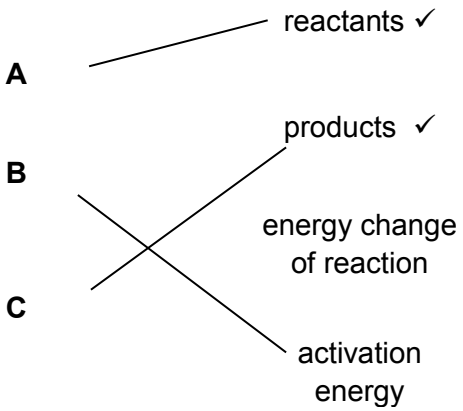
| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 4 | (a) | | magnesium chloride ✓<br>Mg **AND** $H_2$ ✓<br>Correctly balances the equation ie 2(HCl) ✓ | 3 | 2.2 | **ALLOW** correct multiples.<br>**DO NOT ALLOW ECF -** Marking point 3 is dependent upon correct formulae in marking point 2 |
| | (b) | | gas syringe ✓ | 1 | 1.2 | |
| | (c) | (i) | No reaction is happening. ☐<br>The reaction is at its fastest ✓<br>The reaction is speeding up. ☐<br>The reaction is at constant rate ☐ | 1 | 1.2 | |
| | | (ii) | The reaction has stopped. ✓<br>The reaction is at its fastest. ☐<br>The reaction is getting faster. ☐<br>The reaction is at constant rate. ☐ | 1 | 2.2 | |
| | | (iii) | 30 (s) ✓ | 1 | 2.2 | **ALLOW** any value from 25 – 30(s) |
| | | (iv) | 34($cm^3$) ✓ | 1 | 2.2 | |

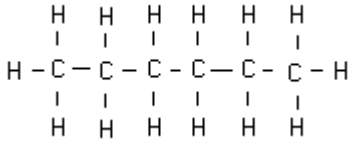
| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 5 | (a) | (i) | The mass of zinc oxide increases ☐<br>The zinc oxide reacts with the air. ☐<br>Zinc oxide loses energy. ☐<br>Zinc oxide loses oxygen. ✓ | 1 | 1.1 | |
| | | (ii) | Aluminium is less reactive than zinc. ☐<br>Aluminium is more reactive than carbon. ✓<br>Aluminium oxide is very rare. ☐<br>Zinc is less reactive than carbon. ✓<br>Zinc oxide melts when it is heated. ☐ | 2 | 1.1 | |
| | (b) | (i) | liquid ✓ | 1 | 1.1 | |
| | | (ii) | Ions/<u>charged</u> particles ✓<br>cannot move <u>in solid</u> / can move when molten/in a liquid ✓ | 2 | 1.1 | **IGNORE** reference to free electrons |
| | | (iii) | negative → aluminium ✓<br>aluminium oxide<br>water<br>positive → hydrogen ✓<br>oxygen | 2 | 2.1 | **ALLOW one mark** for 'aluminium' and 'oxygen' identified as correct products.<br>**DO NOT ALLOW** if more than one line drawn from a box on the left hand side. |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th>True</th><th>False</th></tr>
<tr><td>Most of the mass of the atom is in the nucleus</td><td>✓</td><td></td></tr>
<tr><td>Neutrons have a positive charge</td><td></td><td>✓</td></tr>
<tr><td>The nucleus has an overall positive charge.</td><td>✓</td><td></td></tr>
<tr><td>The nucleus takes up most of the space of the atom</td><td></td><td>✓</td></tr>
</table>
</td><td>3</td><td>1.1</td><td>4 correct = three marks<br>3 correct = two marks<br>2 or 1 correct = one mark</td></tr>
<tr><td></td><td>(b)</td><td></td><td>protons 38 AND electrons 38 ✓<br>neutrons 50 ✓</td><td>2</td><td>2.1<br>2.2</td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Magnesium ion drawn as 2.8<br> <br><br>e.g. ✓<br><br>Oxygen ion drawn as 2.8<br><br><br>e.g. ✓</td><td>2</td><td>2.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Charge on Magnesium ion = +2 ✓<br>Charge on Oxygen ion = -2✓</td><td>2</td><td>2.1</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>165.4 (Rubidium Bromide) ✓<br>$CaBr_2$ (Calcium Bromide)✓<br>247.4 (Strontium Bromide) ✓</td><td>3</td><td>2.2<br>1.1<br>2.2</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><th></th><th>True</th><th>False</th></tr><tr><td>Bonds between metal ions and bromide ions are strong</td><td>✓</td><td></td></tr><tr><td>Metal bromides have covalent bonds.</td><td></td><td>✓</td></tr><tr><td>When metal bromides melt they lose electrons.</td><td></td><td>✓</td></tr><tr><td>It takes a lot of energy to separate the ions</td><td>✓</td><td></td></tr></table></td><td>2</td><td>1.1</td><td>4 correct = two marks<br>3 or 2 correct = one mark<br>1 or 0 correct = zero marks</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>8</td><td>(a)</td><td>(i)</td><td><table><tr><td>The enzyme is a catalyst.</td><td>✓</td></tr><tr><td>The enzyme changes the concentration of the hydrogen peroxide</td><td></td></tr><tr><td>The enzyme causes the temperature to increase.</td><td></td></tr><tr><td>The enzyme provides energy to the reaction</td><td></td></tr></table></td><td>1</td><td>1.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Particles closer together / more particles in same volume / particles more crowded ✓<br>Collisions more frequent / more chance of successful collisions ✓</td><td>2</td><td>1.1</td><td>ALLOW molecules for particles</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>pH meter /pH probe✓<br>Read off numbers/scale ✓<br>OR<br>universal indicator ✓<br>Check colour/pH chart ✓</td><td>2</td><td>1.2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any two from:<br>Enzyme denatured/stops working at pH greater than 6 ✓<br>enzymes have an optimum pH / work best at pH 6 ✓<br>No longer catalyst / activation energy increased / works less well when not at optimum pH. ✓</td><td>2</td><td>1.2</td><td></td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 9 | (a) | | limewater ✓<br>goes cloudy /milky ✓ | 2 | 1.2 | **ALLOW** white precipitate |
| | (b) | | carbon monoxide formed ✓<br><br>poisonous /toxic✓ | 2 | 1.1 | **ALLOW** correct formula<br>**ALLOW** carbon particulates/soot<br>**IGNORE** harmful/dangerous<br>**ALLOW** lung cancer/asthma linked to C particulates<br>(Marking point 2 dependant on Marking point1) |
| | (c) | (i) |  | 2 | 2.1 | 3 correct = two marks<br>2 correct = one mark<br>1 or 0 correct = zero mark<br>**DO NOT ALLOW** if more than one line drawn from a letter on the left hand side. |
| | | (ii) | more than ✓<br>given out ✓<br>exothermic ✓ | 2 | 2.2 | 3 correct = two marks<br>2 correct = one mark<br>1 or 0 correct = zero marks |
| | (d) | | More charcoal particles have enough energy to react ✓<br>The activation energy decreases.<br>The burning firelighter takes energy from the charcoal<br>The charcoal particles increase in energy ✓<br>The reaction becomes more exothermic. | 2 | 1.1<br><br><br><br>2.1 | |

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>10</td><td>(a)</td><td>(i)</td><td>Empirical Formulae = $C_3H_8$ AND $C_2H_5$ ✓<br>Molecular Formula = $C_6H_{14}$ ✓<br>Structural Formula = ✓<br></td><td>3</td><td>2.2</td><td>All bonds must be shown</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><th></th><th>True</th><th>False</th></tr><tr><td>It shows the simplest ratio of atoms in a molecule.</td><td></td><td>✓</td></tr><tr><td>It shows how many atoms are in a molecule.</td><td>✓</td><td></td></tr><tr><td>It shows how the atoms in a molecule are arranged.</td><td>✓</td><td></td></tr><tr><td>It shows the molecule in 3D.</td><td></td><td>✓</td></tr></table></td><td>2</td><td>1.1</td><td>4 correct = two marks<br>3 or 2 correct = one mark<br>1 or 0 correct = zero marks</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>60 to 100°C ✓<br>(actual value 69°C)</td><td>1</td><td>3.2b</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>The values go up and down ✓</td><td>1</td><td>3.2a</td><td>ALLOW fluctuate/ not regular/not flowing in a steady correlation/no trend<br>IGNORE does not change/does not vary</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Liquid ✓<br>Above melting point AND below boiling point ✓</td><td>2</td><td>3.2b</td><td>ALLOW between melting point and boiling point<br>IGNORE melting point and boiling point quoted without reference to above/below/between etc</td></tr>
</table>

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | (iv) | **Any two from:**<br>Boiling points increase as number of carbons increases/Molecules get bigger ✓<br>Intermolecular forces get stronger/more intermolecular forces ✓<br>More energy needed to separate the molecules ✓ | **2** | **2.1** | **IGNORE** boiling points increase down the table<br><br>**IGNORE** bonds if not clear that bonds are iintermolecular<br>**DO NOT ALLOW** stronger intermolecular forces if between atoms/elements<br>**ALLOW** more energy to break intermolecular forces<br>**DO NOT ALLOW** more energy to break it down. |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 11 | (a) | (i) | Their diameters are between 1 to 100nm ✓ | 1 | 1.1 | |
| | | (ii) | Bonds between carbon atoms are strong. ✓<br>Lots of bonds must be broken to break the tube. ✓ | 2 | 1.1 | |
| | | (iii) | **FIRST CHECK THE ANSWER ON ANSWER LINE**<br>**If answer = 2500(mm) award 3 marks**<br>2nm = 2 x $10^{-6}$ mm ✓<br>0.001 ÷ 2 x $10^{-6}$ = 500 ✓<br>500 x 5 = 2500(mm) ✓ | 3 | 1.2<br>2.2x2 | |
| | (b) | | **Benefit**<br>get to where it's needed / less harm to rest of body<br>**Risk**<br>possible side effects/ long term effects not known | 2 | 2.1 | **ALLOW** keeps medicine in one place/non-invasive method/more effective/smaller doses needed/acts as a vector (for the drug)<br>**ALLOW** not enough research/body may reject it/get lost inside the body<br>**IGNORE** references to infection/named side effects/new science/expensive |

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