

GCSE (9-1)

Chemistry B (Twenty First Century)

Unit **J258F/01**: Foundation Tier – Breadth in chemistry

General Certificate of Secondary Education

Mark Scheme for June 2018

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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.

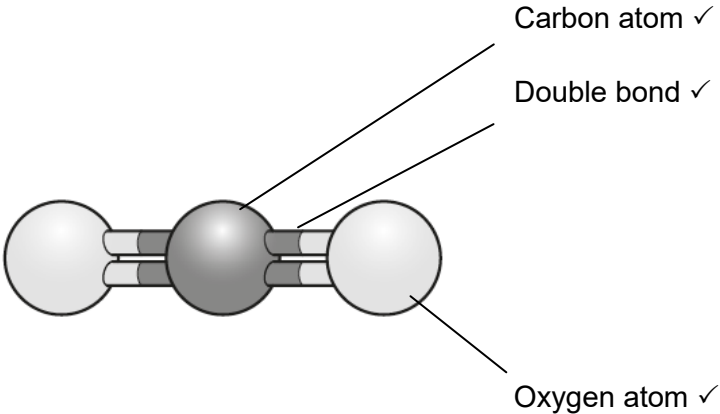
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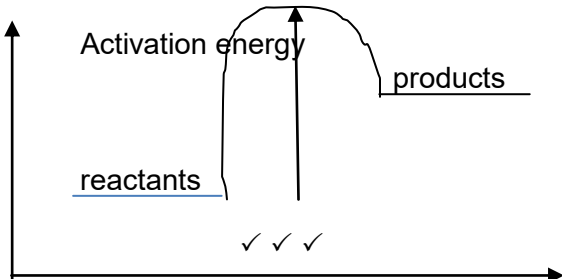
Annotations available in RM Assessor

| 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 |

| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | (a) | Methane ✓ | 1 | 1.1 | |
| | (b) (i) | Irregular rise / generally up but sometimes falls / rises but now constant /AW ✓ | 1 | 3.1a | The candidate must discuss the irregularity of the rise in some way |
| | (ii) | 12 ✓ | 1 | 2.2 | |
| | (c) |  <p>Carbon atom ✓</p> <p>Double bond ✓</p> <p>Oxygen atom ✓</p> | 3 | 1.1 × 3 | <p>ALLOW the double bond line to either (or both) double bond(s)</p> <p>ALLOW oxygen link to either (or both) oxygen atoms</p> <p>DO NOT ALLOW a link to 'ionic bond' as this a CON to the double bond mark.</p> |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|---------------------------------------------------------------------------------------|-------|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | (a) | Adds sherbet powder to water / carries out the reaction ✓ Temperature falls / AW ✓ | 2 | 3.3a 1.1 | Result must relate to an experimentally observable factor i.e. temp [rather than energy] |
| | (b) |  | 3 | 1.1 × 3 | Curve with single hump ✓ Products line labelled and above reactants line ✓ Activation energy unambiguously labelled ✓ This point can only be gained if the products line is above the reactants line |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | (a) | (i) | Hydrogen, nitrogen, oxygen, sulfur ✓ | 1 | 1.1 | Any other boxes ticked are CON |
| | | (ii) | Nitrogen ✓ | 1 | 1.1 | |
| | (b) | (i) | Any one from: artificial fertilisers (can) cause environmental damage ✓ uses a waste product ✓ | 1 | 3.2a | IGNORE 'environmentally friendly' /soil damage ALLOW animals produce it / there are animals on the farm |
| | | (ii) | Any one from: not enough manure/cows AW ✓ supply of natural fertilisers is difficult to manage/transport / AW ✓ composition of natural fertilisers is variable / AW ✓ | 1 | 3.2a | IGNORE 'more effective' unless explained ALLOW easier to use / can be used in smaller amounts / AW ✓ 'quicker' BOD 'more reliable' – not enough detail |
| | (c) | (i) | White ✓ precipitate/solid ✓ Barium sulfate ✓ | 3 | 1.2 x 2 2.1 | IGNORE reference to ammonium chloride |
| | | (ii) | Evaporate the solution ✓ | 1 | 1.2 | |
| | (d) | | FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.21 (kg) award 3 marks 28/132 ✓ = 0.21 (kg) ✓ 2 decimal places ✓ | 3 | 2.2 x 2 1.2 | 212.12 = 2 marks 212.1212 = 1 mark ALLOW the two decimal places as an independent mark. |

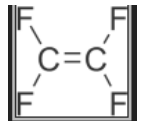
| Question | | Answer | Marks | AO element | Guidance | | | | | | | | | | | | | | | | |
|---------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|------------|------------------------------------------|--------|---------------------------------------------|-----------|--------------|------------|-----------------|--------------|-----------|--------------------------|---------------------|--------|------|-----|---|---------|---------------------------------------------------------------|
| 4 | (a) | <table border="1"> <thead> <tr> <th></th> <th>Chlorine</th> <th>Bromine</th> <th>Iodine</th> </tr> </thead> <tbody> <tr> <td>Appearance at room temperature and pressure</td> <td>Green gas</td> <td>Red liquid ✓</td> <td>Grey solid</td> </tr> <tr> <td>Colour as a gas</td> <td>yellow-green</td> <td>Red-brown</td> <td>Purple/mauve Violet ✓</td> </tr> <tr> <td>Product with sodium</td> <td>NaCl ✓</td> <td>NaBr</td> <td>NaI</td> </tr> </tbody> </table> | | Chlorine | Bromine | Iodine | Appearance at room temperature and pressure | Green gas | Red liquid ✓ | Grey solid | Colour as a gas | yellow-green | Red-brown | Purple/mauve Violet ✓ | Product with sodium | NaCl ✓ | NaBr | NaI | 3 | 1.1 × 3 | ALLOW all the usual alternatives for colour of bromine |
| | Chlorine | Bromine | Iodine | | | | | | | | | | | | | | | | | | |
| Appearance at room temperature and pressure | Green gas | Red liquid ✓ | Grey solid | | | | | | | | | | | | | | | | | | |
| Colour as a gas | yellow-green | Red-brown | Purple/mauve Violet ✓ | | | | | | | | | | | | | | | | | | |
| Product with sodium | NaCl ✓ | NaBr | NaI | | | | | | | | | | | | | | | | | | |
| | (b) (i) | potassium chloride ✓ KBr ✓ | 2 | 2.2 × 2 | Symbol for Br must be correct | | | | | | | | | | | | | | | | |
| | (ii) | (because) bromine is formed / bromine is red-brown ✓ | 1 | 2.1 | DO NOT ALLOW 'bromide' references | | | | | | | | | | | | | | | | |

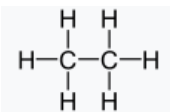
| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|-------------------------------------------|-------|------------|-----------------------------------------------------|
| 5 | (a) | R, and it conducts electricity ✓ | 1 | 1.1 | IGNORE other comments |
| | (b) | R ✓ | 1 | 2.1 | If more than one option given, CON |
| | (c) | Q ✓ noble gas / Group 0 / unreactive ✓ | 2 | 2.1 × 2 | Mark independently ALLOW full outer shell |
| | (d) | Giant ionic ✓ | 1 | 2.1 | |
| | (e) | 16 ✓ | 1 | 1.1 | ALLOW '2:8:6' |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|----------------------------------------|
| 6 | (a) | chloride ✓ positive ✓ electrons ✓ | 3 | 1.1 × 3 | |
| | (b) | Chlorine turns litmus (red then) bleached ✓ hydrogen pops when lit ✓ Oxygen should relight glowing splint / spill / AW ✓ | 3 | 1.2 × 3 | ALLOW lit splint burns brighter |

| Question | | | Answer | Marks | AO element | Guidance | | | | | | | | | | | | | | | |
|-------------------------------------------|------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|--------------------------------|----------------------------------------|--|---|--------------------------------|---|--|-------------------------------------------|---|--|--------------------------------|--|---|---|--------------------------|--|
| 7 | (a) | (i) | Manganese oxide + carbon → carbon oxide/monoxide/dioxide + manganese ✓ | 1 | 1.2 | IGNORE symbol equations | | | | | | | | | | | | | | | |
| | | (ii) | <table border="1"> <thead> <tr> <th></th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>Carbon is more reactive than aluminium</td> <td></td> <td>✓</td> </tr> <tr> <td>Carbon reduces manganese oxide</td> <td>✓</td> <td></td> </tr> <tr> <td>Aluminium is more reactive than manganese</td> <td>✓</td> <td></td> </tr> <tr> <td>Carbon reduces aluminium oxide</td> <td></td> <td>✓</td> </tr> </tbody> </table> | | True | False | Carbon is more reactive than aluminium | | ✓ | Carbon reduces manganese oxide | ✓ | | Aluminium is more reactive than manganese | ✓ | | Carbon reduces aluminium oxide | | ✓ | 4 | 1.1 2.1 2.1 2.1 | |
| | True | False | | | | | | | | | | | | | | | | | | | |
| Carbon is more reactive than aluminium | | ✓ | | | | | | | | | | | | | | | | | | | |
| Carbon reduces manganese oxide | ✓ | | | | | | | | | | | | | | | | | | | | |
| Aluminium is more reactive than manganese | ✓ | | | | | | | | | | | | | | | | | | | | |
| Carbon reduces aluminium oxide | | ✓ | | | | | | | | | | | | | | | | | | | |
| | (b) | (i) | Middle diagram ringed ✓ | 1 | 1.1 | | | | | | | | | | | | | | | | |
| | | (ii) | Left-hand box: (lattice of) metal/positive ion(s) AND Right-hand box: ('sea' of freely moving / delocalised) electron(s) ✓ | 1 | 1.1 | | | | | | | | | | | | | | | | |

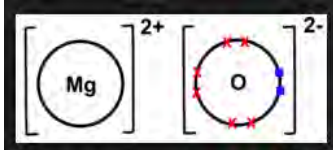
| Question | Answer | Marks | AO element | Guidance |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 8 (a) | OH ⁻ ✓ | 1 | 1.1 | |
| (b) (i) | Idea of dividing cost by cm ³ OR A ✓ Some comparison of unit costs, eg: Gutcalm £1.75 / 24 = £0.073 per cm ³ Milkomag £1.50 / 21 = £0.071 per cm ³ so better ✓ | 2 | 3.1a 3.2a | There must be some indication that a calculation has been performed IGNORE incorrect rounding as assessed elsewhere |
| (ii) | Use a volumetric pipette ✓ | 1 | 2.2 | |

| Question | Answer | Marks | AO element | Guidance |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|----------------------------------------------------------------------------------------------------------------------------------------|
| 9 (a) | A High relative breaking strength / less likely to break ✓ High temperature needed to soften ✓ OR C Any two from: Low cost ✓ Quite a high temperature needed to soften ✓ It is stiff ✓ | 2 | 3.2a × 2 | DO NOT credit choice without reason(s) IGNORE flexible, references to boiling point |
| (b) | B ✓ if correct, look for 2 nd mark (Lowest) softening temperature ✓ | 2 | 3.2a × 2 | Only allow the 2 nd mark if 'B' is given. ALLOW breaking strength IGNORE flexibility CON cost |
| (c) |  ✓ | 1 | 2.1 | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|----------------------------------------------------------|
| 10 | (a) | Alkene ✓ | 1 | 1.1 | |
| | (b) | Any two from: fossil fuels running out / not sustainable ✓ burning fossil fuels produces pollutants ✓ alternatives to fossil fuels are increasingly used ✓ | 2 | 1.1 × 2 | IGNORE green / environmentally friendly arguments |
| | (c) (i) | Yes, because there are three hydrogens per carbon / AW ✓ | 1 | 2.2 | |
| | (ii) | Carbon always forms four bonds ✓ | 1 | 2.1 | |
| | (iii) |  ✓ | 1 | 2.1 | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11 | (a) | 10 nm ✓ | 1 | 1.1 | |
| | (b) | Uses less ✓ (large surface area means) faster / AW ✓ | 2 | 1.1 × 2 | |
| | (c) | Any two from: Carbon monoxide / CO ✓ (carbon) particulates ✓ unburnt fuel / AW ✓ | 2 | 1.1 × 2 | IGNORE carbon dioxide |
| | (d) (i) | 4+ ✓ | 1 | 2.1 | |
| | (ii) | FIRST CHECK ANSWER ON ANSWERLINE If answer = 81 / 81.25 / 81.3 (%) award 3 marks Mass Ce = 160 – 30 OR 130g ✓ = $130 \times 100/160$ ✓ = 81 (%) ✓ | 3 | 1.2 × 3 | ALLOW ecf if % oxygen calculated. Working is then essential eg $30 \times 100/160$ ✓ = 18.75(%) or 19(%) ✓ But 19(%) without working gains no credit . |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12 | (a) | <p>FIRST CHECK ANSWER ON ANSWER LINE If answer = 0.08 ± 1 (cm³/s) award 2 marks</p> <p>Change in volume = 8 ± 1 (cm³) ✓</p> <p>rate = $8 / 100 = 0.08$ (cm³/s) ✓</p> | 2 | 2.2 × 2 | <p>ALLOW use of any number 7- 9 anywhere in calculation (1)</p> <p>ALLOW ECF for 2nd mark: rate = change in volume / 100 ALLOW 0.07 – 0.09 (2)</p> |
| | (b) | <p>“Particle size” of carbonate / AW ✓</p> <p>Temperature ✓</p> | 2 | 3.3a × 2 | <p>ALLOW take readings every 200s or less/ same time interval IGNORE ‘the same time’</p> |
| | (c) | <p>Particles closer/have less space / more particles in same volume / more (densely) packed ✓</p> <p>Collide more frequently / higher rate of collisions / more collisions per unit time/per second ✓</p> | 2 | 2.1 × 2 | <p>ALLOW molecules for particles</p> <p>ALLOW more chance of collisions</p> <p>IGNORE more particles / more collisions / faster collisions / energy arguments / more successful collisions /</p> |
| | (d) | <p>FIRST CHECK ANSWER ON ANSWER LINE If answer = 17 (cm³) award 3 marks</p> <p>0.07 / 0.10 or 0.10/0.07 ✓</p> <p>(uses 24)= 16.8 ✓</p> <p>= 17 (cm³) ✓</p> | 3 | <p>2.2 × 2</p> <p>1.2</p> | <p>IGNORE 17.0 ALLOW MP3 for (incorrect) answer with working rounded to 2sf</p> |

| Question | | Answer | Marks | AO element | Guidance | |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| 13 | (a) | No overall loss (in mass) idea / No elements/mass/atoms/chemicals/particles/compounds lost / law states that matter is neither (created nor) destroyed in a chemical reaction / AW ✓ Carbon dioxide is a gas / Carbon dioxide leaves the test tube / a gas is given off / idea that all products are not in the test tube / AW ✓ | 2 | 3.1b x 2 | ALLOW It is an open system | |
| | (b) | FIRST CHECK ANSWER ON ANSWER LINE If answer = 52.2 / 52.4 / 52.3 (%) award 4 marks (formula mass of reactants or MgCO_3) = 84.3/84 ✓ (formula mass of product or CO_2) = 44 ✓ Correct substitution = $44/84.3 \times 100$ / $44/84 \times 100$ ✓ Ans+dec pl= 52.2 / 52.4 / 52.3 (%) (1 decimal place) ✓ | 4 | 2.2 x 3 1.2 | If no marks awarded for MP3 and MP4 ALLOW correct working towards formula masses for max (2) $24(.3) + 12 + (3 \times 16) / 12 + (2 \times 16)$ ALLOW ecf ALLOW 52.1(%) (Rounding assessed in previous question) | |
| | (c) | (i) | 2.2 (g) ✓ | 1 | 2.2 | ALLOW 2 or more sf |
| | | (ii) | 82(%) ✓ | 1 | 2.2 | ALLOW 2 or more sf |
| | (d) |  Ions with correct electrons ✓ Charges ✓ | 2 | 1.2 x 2 | ALLOW (1) for one correct ion ALLOW eight electrons in outer shell of Mg ALLOW all oxygen electrons with same symbol IGNORE correct inner shells DO NOT ALLOW incorrect inner shells | |

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