

GCSE

Chemistry B

Unit **B741/01**: Modules C1, C2, C3 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2017

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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 used in scoris

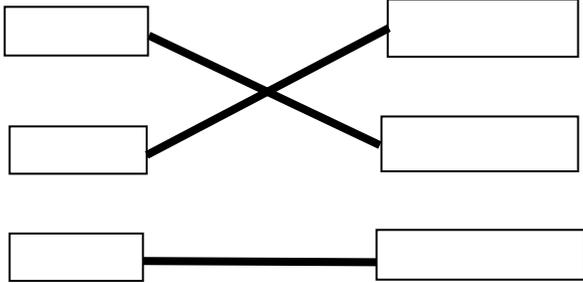
| Annotation | Meaning |
|---|---------------------------------------|
|  | correct response |
|  | incorrect response |
|  | benefit of the doubt |
|  | benefit of the doubt not given |
|  | error carried forward |
|  | information omitted |
|  | ignore |
|  | reject |
|  | contradiction |

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

- / = alternative and acceptable answers for the same marking point
- (1) = separates marking points
- allow** = answers that can be accepted
- not** = answers which are not worthy of credit
- reject** = answers which are not worthy of credit
- ignore** = statements which are irrelevant
- () = words which are not essential to gain credit
- = underlined words must be present in answer to score a mark (although not correctly spelt unless otherwise stated)
- ecf = error carried forward
- AW = alternative wording
- ora = or reverse argument

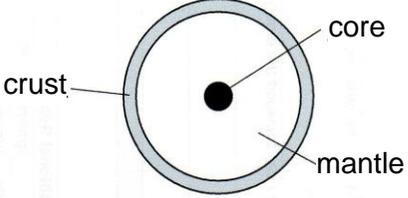
MARK SCHEME

| Question | Answer | Marks | Guidance |
|----------|---|----------|---|
| 1 a i | B / purple (1) colour fades in both light and temperature (1) | 2 | award 0 marks for the question with incorrect choice |
| ii | C / pink (1) changes colour as the temperature changes (1) | 2 | award 0 marks for the question with incorrect choice but second mark can be given if no choice given |
| b | solvent – thins the paint (1) binding medium – sticks the pigment to the surface (1) | 2 | allow solvent dissolves other constituents / makes the paint easier to run / so it is easier to spread (1) allow sticks the paint to the surface (1) not binds the pigment together / binds pigment to solvent |
| | Total | 6 | |

| Question | Answer | Marks | Guidance |
|----------|--|----------|---|
| 2 a | acid + alcohol → ester + water (1) | 1 | allow a named alcohol e.g. ethanol (1) allow phonetic spelling |
| b | perfumes (1) | 1 | allow pear drops / food flavours / air freshener / deodorants (1) food additive it not sufficient |
| c |  <p>(2)</p> | 2 | all correct (2) one or two correct (1) |
| d | any two from: to check they are not poisonous or toxic (1) to check they do not irritate skin (1) to check they do not stain (1) to check they are safe (1) | 2 | allow to check if they are harmful (1) allow to see if there is a reaction with skin (1) allow to check if they are dangerous (1) allow to check for 'side-effects' / to check to see if there is a reaction (1) ignore testing the smell or odour |
| | Total | 6 | |

| Question | Answer | Marks | Guidance |
|----------|--|----------|---|
| 3 a | B (1) | 1 | allow ethene / C ₂ H ₄ (1) but letter takes precedence |
| b | A (1) | 1 | allow methane / CH ₄ (1) but letter takes precedence |
| c | B (1) | 1 | allow ethene / C ₂ H ₄ (1) but letter takes precedence |
| d | C (1) | 1 | allow poly(bromoethene) / (C ₂ H ₃ Br) _n (1) but letter takes precedence (1) |
| e | land fill (1) burning / incinerating (1) recycling (1) | 3 | allow put on tip / bury underground (1) ignore reuse them allow cracked (to make new monomers) (1) ignore put in the bin ignore turn it into a gas not broken down into smaller polymers |
| | Total | 7 | |

| Question | Answer | Marks | Guidance |
|----------|--|-------|---|
| 4 | <p>Level 3 States two other factors to be considered AND chooses A or B with at least two reasons Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>Level 2 States two other factors to be considered OR States one other factor and chooses A or B with a reason OR chooses A or B with at least two reasons Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks)</p> <p>Level 1 States one other factor to be considered OR chooses A or B with a reason Quality of written communication impedes communication of the science at this level. (1 – 2 marks)</p> <p>Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p> | 6 | <p>This question is targeted at grades up to grade C.</p> <p>Indicative scientific points may include:</p> <p>Other factors</p> <ul style="list-style-type: none"> • availability • storage • toxicity • ease of use • amount of ash or smoke produced • physical state of fuel • renewability • flammability / does it explode easily • how long to make the fuel <p>ignore general references to pollution</p> <p>Choice and reasons</p> <ul style="list-style-type: none"> • A because it has a high energy value, only makes carbon dioxide and is reasonably cheap • B because it is cheap and has many years supply <p>Use the L1, L2, L3 annotations in Scoris; do not use ticks.</p> |
| | | 6 | |

| Question | Answer | Marks | Guidance |
|----------|---|-------|--|
| 5 a |  <p>(2)</p> | 2 | <p>all three labels correct (2)</p> <p>one or two labels correct (1)</p> <p>allow inner core for core but not outer core</p> <p>allow inner or outer crust for crust</p> |
| b | <p>any two from:</p> <p>soil is (very) fertile / crops grow better / aw (1)</p> <p>provide geothermal energy / used to heat water / cheap source of heat (1)</p> <p>idea of taking advantage of tourists (1)</p> <p>idea that people may want to study the volcano (1)</p> | 2 | <p>allow soil has many nutrients present (1)</p> <p>ignore soil is good unless qualified, e.g. can grow bigger crops or soil good for crops would be sufficient to gain a mark</p> <p>ignore for warmth</p> <p>views and attractiveness is not sufficient</p> <p>allow want to live in same place (as rest of family) (1)</p> <p>allow housing may be cheap / land may be cheap (1)</p> <p>ignore because there is nowhere else to go</p> |

| Question | Answer | Marks | Guidance |
|----------|---|----------|--|
| 5 c | <p>any one from:</p> <p>(scientific) conference / lecture (1) (scientific) paper / journal / magazine (1) internet / blog / Twitter / Facebook (1) email (1) book (1) newspaper (1) television (1)</p> <p>AND</p> <p>any one from:</p> <p>work can be checked (1) to see if work can be replicated / so work does not need to be duplicated (1) so that further evidence can be collected (1) to provide information to other scientists or public or other organisations / AW (1) so they can get recognition for their work (1) for education (1)</p> | 2 | <p>send it to a scientist is not sufficient</p> <p>allow media or write up his work or writing down his work if no other marks scored from this section (1)</p> <p>allow peer-review / work can be evaluated (1)</p> <p>allow work can be developed further (1)</p> <p>allow so other scientists cannot take credit (1)</p> <p>allow to help predict other eruptions (1)</p> <p>allow so others know what they have done (1)</p> |
| | Total | 6 | |

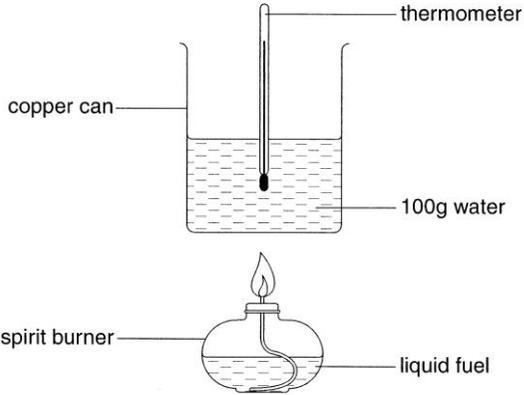
| Question | Answer | Marks | Guidance | | | | | | | | | | |
|--------------|---|----------|---|---|---|---|---|---|---|---|---|---|--|
| 6 a | ammonia + sulfuric (acid) → ammonium sulfate (1) | 1 | <p>allow = or \rightleftharpoons instead of \rightarrow not 'and' or '&' instead of '+'</p> <p>allow $\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ balancing not required</p> <p>allow mix of correct names and correct formulae if mix of names and formulae, name takes precedence</p> <p>ignore + water as a product</p> | | | | | | | | | | |
| b | potassium nitrate (1) | 1 | allow KNO_3 but name takes precedence (1) | | | | | | | | | | |
| c | burette (1) | 1 | allow correct answer ticked, circled or underlined in list if answer line is blank | | | | | | | | | | |
| d | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Atom</th> <th>Number</th> </tr> </thead> <tbody> <tr> <td>N</td> <td>1</td> </tr> <tr> <td>H</td> <td>6</td> </tr> <tr> <td>P</td> <td>1</td> </tr> <tr> <td>O</td> <td>4</td> </tr> </tbody> </table> | Atom | Number | N | 1 | H | 6 | P | 1 | O | 4 | 2 | <p>all four correct (2)</p> <p>two or three correct (1)</p> |
| Atom | Number | | | | | | | | | | | | |
| N | 1 | | | | | | | | | | | | |
| H | 6 | | | | | | | | | | | | |
| P | 1 | | | | | | | | | | | | |
| O | 4 | | | | | | | | | | | | |
| Total | | 5 | | | | | | | | | | | |

| Question | Answer | Marks | Guidance |
|----------|--|----------|---|
| 7 a | nitrogen obtained from air (1) hydrogen obtained from natural gas / hydrogen obtained by cracking oil fractions (1) | 2 | |
| b | reaction that goes both ways / AW (1) | 1 | allow returns to original reactants / goes back to where it started (1) allow idea that you can get the reactants back, this may be in the form of a word equation (1) allow the reaction can go backwards and forwards / reaction can be undone ignore 'a reaction that can be reversed' ignore can get elements back ignore physical processes mentioned |
| c | manufacture of nitric acid / manufacture of explosives / use in cleaning fluids / manufacture of dyes / manufacture of plastics / manufacture of drugs (1) | 1 | ignore to make beach |
| d | (pressure) 400 (atmospheres) and (temperature) 100 (°C) (1) | 1 | both required allow any pressure above 400 and any temperature below 100 |
| | Total | 5 | |

| Question | Answer | Marks | Guidance |
|----------|---|-------|--|
| 8 a | E (1) | 1 | |
| b | <p>(yes because)</p> <p>idea that this alloy is a good conductor (of electricity) (1)</p> <p>and has good ductility / can easily be pulled into wires (1)</p> | 2 | <p>marks are for explanation BUT just quoting numbers is insufficient</p> <p>just 'conducts (electricity)' is not sufficient</p> <p>not it has the highest (electrical) conductivity</p> <p>just 'it is ductile' / 'it is quite ductile' / 'it is fairly ductile' is not sufficient</p> <p>ignore comments about strength</p> <p>ignore comments about other brasses BUT allow no use A because it is the best conductor (of electricity) (1)</p> |

| Question | Answer | Marks | Guidance | | | | | | | | | | | | |
|--------------------------------|---|----------|--|--------------------------------|-------------|---------------------------|--------------------------------------|------------------|--|-----------|----------------------|--------|--------------------------|------|---------------|
| 8 c | <p>Level 3 Identifies and explains at least one relevant property needed in making helicopters</p> <p>AND</p> <p>Explains which metal (aluminium, steel or both) is suited to make helicopters Quality of written communication does not impede communication of the science at this level. (5–6 marks)</p> <p>Level 2 Identifies and explains at least one relevant property needed in making helicopters</p> <p>OR</p> <p>Explains which metal (aluminium, steel or both) is suited to make helicopters Quality of written communication partly impedes communication of the science at this level. (3–4 marks)</p> <p>Level 1 Identifies at least one relevant property of metals needed to make a helicopter. Quality of written communication impedes communication of the science at this level. (1–2 marks)</p> <p>Level 0 Insufficient or irrelevant science such as repeating the question. Answer not worthy of credit. (0 marks)</p> | 6 | <p>This question is targeted at grades up to C</p> <p>Relevant scientific points at level 3 may include:</p> <table border="1" data-bbox="1167 384 2000 695"> <thead> <tr> <th data-bbox="1167 384 1451 451">Property for making helicopter</th> <th data-bbox="1451 384 2000 451">Explanation</th> </tr> </thead> <tbody> <tr> <td data-bbox="1167 451 1451 518">low density / lightweight</td> <td data-bbox="1451 451 2000 518">so less fuel needed / travels faster</td> </tr> <tr> <td data-bbox="1167 518 1451 585">does not corrode</td> <td data-bbox="1451 518 2000 585">will last longer / no need to pay for rust treatment</td> </tr> <tr> <td data-bbox="1167 585 1451 620">malleable</td> <td data-bbox="1451 585 2000 620">can be easily shaped</td> </tr> <tr> <td data-bbox="1167 620 1451 655">strong</td> <td data-bbox="1451 620 2000 655">less damage (in a crash)</td> </tr> <tr> <td data-bbox="1167 655 1451 691">hard</td> <td data-bbox="1451 655 2000 691">not scratched</td> </tr> </tbody> </table> <p>ignore strong so lasts a long time</p> <p>Relevant scientific point at all levels may include:</p> <p>Aluminium is used to make helicopters because it is</p> <ul data-bbox="1211 906 1581 1007" style="list-style-type: none"> • lower density / lightweight • does not corrode • malleable. <p>Steel is used to make helicopters because it is</p> <ul data-bbox="1211 1082 1368 1182" style="list-style-type: none"> • stronger • malleable • cheaper <p>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</p> | Property for making helicopter | Explanation | low density / lightweight | so less fuel needed / travels faster | does not corrode | will last longer / no need to pay for rust treatment | malleable | can be easily shaped | strong | less damage (in a crash) | hard | not scratched |
| Property for making helicopter | Explanation | | | | | | | | | | | | | | |
| low density / lightweight | so less fuel needed / travels faster | | | | | | | | | | | | | | |
| does not corrode | will last longer / no need to pay for rust treatment | | | | | | | | | | | | | | |
| malleable | can be easily shaped | | | | | | | | | | | | | | |
| strong | less damage (in a crash) | | | | | | | | | | | | | | |
| hard | not scratched | | | | | | | | | | | | | | |
| | Total | 9 | | | | | | | | | | | | | |

| Question | Answer | Marks | Guidance |
|----------|---|----------|---|
| 9 a | 151 (1) | 1 | |
| b | method D (1) highest atom economy and highest percentage yield (1) | 2 | explanation mark is dependent on mentioning both atom economy and percentage yield |
| c | any two from: labour / salaries / workers (1) energy / electricity / gas (1) research and testing / quality control (1) time taken for development (1) marketing (1) rent / rates / taxes / insurance (1) plant / buildings / machinery / equipment (1) maintenance / repair / health & safety (1) pollution controls (1) | 2 | allow mark for an explanation of the cost e.g. needs specialist workers so costs a lot of money allow cost of temperature ignore transport / packaging / storage |
| d | idea that impurities might give side effects (1) | 1 | allow idea that cannot give correct dosage with impure drug (1) allow impurities may be toxic / may have (allergic) reaction to the impurities safe to use is not sufficient |
| | Total | 6 | |

| Question | Answer | Marks | Guidance |
|----------|---|-------|--|
| 10 a |  <p>any three from:</p> <p>suitable container for fuel (1)</p> <p>suitable container of water above burning flame (1)</p> <p>use of thermometer in the water (1)</p> <p>fair test – same mass or volume or amount of water in copper can / same distance between burner and copper can / use same burner each time / same copper can / same size flame or wick (1)</p> | 3 | <p>if experiment is unsafe, or incorrect experiment, max 1</p> <p>marks can be awarded from a labelled diagram or written answer</p> <p>allow paraffin burner / crucible with fuel not Bunsen burner</p> <p>ignore same mass of fuel</p> |
| b | <p>(yes because)</p> <p>fuel B gave same temperature rise as other fuels (1)</p> <p>for least mass of fuel burned (1)</p> | 2 | <p>marks are for explanation</p> <p>allow temperature rise was 20°C for all fuels</p> <p>allow only 0.6g of fuel burned i.e. answers must be comparative</p> |

| Question | Answer | Marks | Guidance | | | | | | | | |
|--------------|---|----------|---|---|---|---|----|---|---|---|---|
| 10 c | energy given out or heat given out (1) | 1 | <p>allow temperature (of surroundings) increase</p> <p>allow heat or energy produced / made / exits / released</p> <p>allow energy or heat is lost (limit of acceptability)</p> <p>ignore gives more energy</p> <p>not energy or heat is created</p> | | | | | | | | |
| d | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>atom</th> <th>number</th> </tr> </thead> <tbody> <tr> <td>C</td> <td>4</td> </tr> <tr> <td>H</td> <td>10</td> </tr> <tr> <td>O</td> <td>1</td> </tr> </tbody> </table> <p style="text-align: right;">(2)</p> | atom | number | C | 4 | H | 10 | O | 1 | 2 | <p>all three correct (2)</p> <p>one or two correct (1)</p> |
| atom | number | | | | | | | | | | |
| C | 4 | | | | | | | | | | |
| H | 10 | | | | | | | | | | |
| O | 1 | | | | | | | | | | |
| Total | | 8 | | | | | | | | | |

| Question | Answer | Marks | Guidance |
|----------|--|-------|---|
| 11 a | calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water (1) | 1 | <p>order of substances on either side of arrow is unimportant</p> <p>allow marble for calcium carbonate</p> <p>allow mixture of correct formulae and names but names take precedence</p> <p>allow correct formulae, i.e. (1) $\text{CaCO}_3 + \text{HCl} \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O}$ balancing is not required</p> |

| | | | |
|--------------|---|---|---|
| | | | allow = or = for arrow not 'and' or & for + |
| b i | 0.49 / 0.5 (g) (1) | 1 | |
| b ii | 2.9 / 3.0 (minutes) (1) | 1 | allow just '3' (minutes) |
| b iii | curve for small chips is steeper / ora (1) | 1 | assume unqualified answer refers to small marble chips allow for a given time more gas with smaller chips (1) allow reaction finishes in shorter time / reaction finishes before the large chips / curve ends first / reaction stops sooner (1) ignore references to reaction finishes in a faster / quicker time allow numbers quoted from the graph but they must be correct to within $\pm\frac{1}{2}$ square |
| c | idea that powders are very flammable / idea that powders can lead to explosions (1) | 1 | allow reference to choking hazard allow respiratory or breathing problems |

| Question | Answer | Marks | Guidance |
|----------|--|-------|--|
| d | <p>Level 3 Answer applies understanding of the reacting particle model (with collisions) to explain how increasing the temperature AND increasing the concentration of the acid will increase the rate of reaction. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks)</p> <p>Level 2 Answer applies understanding of the reacting particle model (collisions) to explain how increasing the temperature increases the rate of</p> | 6 | <p>This question is targeted at grades up to C</p> <p>Indicative scientific points may include:</p> <ul style="list-style-type: none"> more collisions between particles result in faster reaction <p>temperature increase: increasing the temperature of the increases the rate of reaction because</p> <ul style="list-style-type: none"> idea that particles move faster / particles have more energy / more (successful) collisions / collisions are more energetic idea of increased collisions (frequency) |

| | | | |
|---|--|-----------|---|
| <p>reaction OR increasing the concentration of the acid increases the rate of reaction.</p> <p>OR</p> <p>Answer applies understanding of the reacting particle model (no collisions) to explain how increasing the temperature increases the rate of reaction AND increasing the concentration of the acid increases the rate of reaction</p> <p>Quality of written communication partly impedes communication of the science at this level.</p> <p style="text-align: right;">(3 – 4 marks)</p> <p>Level 1</p> <p>Answer describes that increasing the temperature and increasing the concentration will increase the rate of reaction</p> <p>OR</p> <p>describes that more collisions will increase the rate of reaction.</p> <p>Quality of written communication impedes communication of the science at this level.</p> <p style="text-align: right;">(1 – 2 marks)</p> <p>Level 0</p> <p>Insufficient or irrelevant science. Answer not worthy of credit</p> <p style="text-align: right;">(0 marks).</p> | | 11 | <p>concentration increase:</p> <p>increasing the concentration of a reactant increases the rate of reaction because</p> <ul style="list-style-type: none"> • idea of more crowded particles / more particles in same volume • idea of increased collisions (frequency) <p>ignore references to 'more particles'</p> <p>allow increase in pressure / shaking / swirling as another method of increasing the rate of reaction</p> <p>pressure increase:</p> <p>increasing the pressure of a (gaseous) reactant increases the rate of reaction because</p> <ul style="list-style-type: none"> • idea of more crowded particles / more particles in same volume • idea of increased collisions (frequency) <p>ignore references to 'more particles'</p> <p>allow reference to ions / atoms / molecules instead of particles</p> <p>Use the L1, L2, L3 annotations in Scoris. Do not use ticks.</p> |
| Total | | 11 | |

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