# Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCSE
In Chemistry (5CH3H) Paper 01

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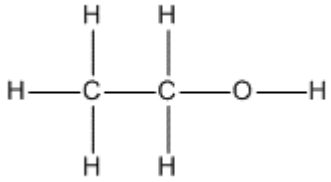
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**General Marking Guidance**

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **1(a)(i)** | $C_5H_{11}OH$ | must be capital letters: reject h, c or o<br>must be subscripts: reject C5H11OH or $C^5H^{11}OH$<br><br>allow $C_5H_{12}O$<br>$C_5$ , $H_{12}$ and O can be in any order | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **1(a)(ii)** |  | allow -OH for O-H, but reject -HO<br><br>ignore bond angles<br>reject C=C<br>allow c or h or o<br>permit fully correct dot and cross | **(1)** |

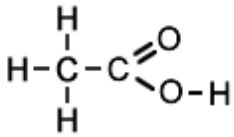
| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **1(b)(i)** | ($C_2H_5OH \rightarrow$) $C_2H_4 + H_2O$<br><br>fully balanced equation (allow multiples) (2)<br><br>allow formulae in either order<br><br>If does not score 2, allow 1 for either formula. | must be capital letters: reject h, c or o<br>must be subscripts: reject C2H4 or $C^2H^4$ or H2O or $H^2O$<br><br>allow structural formulae | **(2)** |

| Question Number | Answer | Mark |
|---|---|---|
| **1(b)(ii)** | ☒ **A dehydration**<br><br>**The only correct answer is A**<br><br>**B** is not correct because this is not a reaction type<br><br>**C** is not correct because water is removed, not added<br><br>**D** is not correct because there is no oxygen added, but water | **(1)** |

| Question Number | Answer | Mark |
|---|---|---|
| **1(c)** | ☒ **C** $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$<br><br>**The only correct answer is C**<br><br>**A** is not correct because there are insufficient oxygen atoms on LHS<br><br>**B** is not correct because there are insufficient oxygen atoms on LHS<br><br>**D** is not correct because there are too many oxygen atoms on LHS | **(1)** |

**(Total for Question 1 = 6 marks)**

| Question Number | Answer | Mark |
|---|---|---|
| **2(a)** | **B** oxidised<br><br>**The only correct answer is B**<br><br>**A** is not correct because it is not a reaction with a base<br><br>**C** is not correct because ethanol is not a solid product from solutions<br><br>**D** is not correct because oxygen is added, not removed | **(1)** |

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **2(b)** |  | allow -OH<br>allow $CH_3$-<br><br>ignore bond angles<br>allow c or h or o | **(1)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **2(c)(i)** | (magnesium + ethanoic acid) →<br><br>magnesium ethanoate **(1) +** hydrogen **(1)** | ignore any formulae<br>words in either order<br><br>**exact spellings required** | **(2)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **2(c)(ii)** | effervescence / fizzing / bubbles / (magnesium) disappears | allow magnesium gets smaller / dissolves<br>ignore movement / floating<br><br>**reject** answers with additional incorrect response e.g. white precipitate / colour change / steam | **(1)** |

| Question Number | Answer | | Acceptable | Mark |
|---|---|---|---|---|
| **2(d)** | A description **linking one use with <u>relevant property</u>** | | ignore polyesters fabrics / clothing<br><br>allow specified tastes<br><br>**MP2 dependent on MP1** | **(2)** |
| | sweets / confectionary / food (flavouring) (1) | flavouring / good taste / fruity or sweet smell or taste (1) | | |
| | perfumes / cosmetics / named cosmetic item (1) | good smell/ scent / volatile (1) | | |
| | soap (1) | esters react with NaOH / sweet smell (1) | | |
| | paints / nail varnish remover(1) | solvent (1) | | |
| | plastics / resins (1) | softening agent (1) | | |

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **2(e)** | A description including<br><br>• sodium hydroxide / potassium hydroxide / alkali / base **(1)**<br><br>• heat / boil / reflux **(1)**<br><br>**MP2 is dependent on scoring MP1** | MP1: allow **correct** formulae / equations reject **dilute** alkali or 'alkaline' but allow MP2<br>MP2: allow specified temps ≥ 80 °C but ignore warm | **(2)** |

**(Total for Question 2 = 9 marks)**

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **3(a)** | calcium / $Ca^{2+}$ / magnesium / $Mg^{2+}$ | allow +2 for 2+, must have correct charge. Reject $mg^{2+}$<br>if a list, all must be correct | **(1)** |

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **3(b)** | An explanation including<br>• A temporary hardness<br>**and**<br>little or less soap needed (after boiling) / ($10.2cm^3$ before but) only $0.1cm^3$ after / softened (by boiling) / (all) hardness removed / more easily lathers (1)<br><br>• B permanent hardness<br>**and**<br>no change (in soap used) / $20cm^3$ before and after / has not been softened (by boiling) (1)<br><br>• C temporary <u>and</u> permanent hardness / 'both' types<br>**and**<br>only some reduction in soap needed (1)<br><br>If gets no marks, allow 1 for:<br>A temporary, B permanent, C temporary and permanent (1) | do not allow 'partially hard' etc<br>do not allow <u>unexplained</u> use of data for MP3 | **(3)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **3(c)(i)** | $ZnCO_3 + 2HCl \rightarrow ZnCl_2 + H_2O + CO_2$<br><br>• correct formulae only LHS **(1)**<br><br>• correct formulae only RHS **(1)**<br><br>• balancing of **these** correct formulae **(1)** | ignore state symbols, even if incorrect<br>allow = for →, multiples<br><br>In this question only, incorrect use of capital / small letters or subscripts: max 2. | **(3)** |

| Question Number | Answer | Acceptable answers | Mark |
|---|---|---|---|
| **3(c)(ii)** | • relative formula mass<br>$ZnCl_2$ = [65 + 2 x 35.5] **(1)**<br>(= 136)<br><br>• concentration = 0.25 x $M_r$ **(1)**<br>**(**= 34(.0)) | 136 scores 1.<br>34 as final answer scores 2.<br><br>allow ecf for $M_r$ | **(2)** |

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **3(d)** | • mol HCl used = 0.095 x 18.5 / 1000 **(1)**<br>(= 0.0017575)<br><br>• conc NaOH = 0.0017575 x 1000 / 25.0 **(1)**<br>(= 0.07(03)) | 0.07(03) as final answer scores 2.<br><br>allow ecf for moles<br>allow 18.5 x 0.095 = 25 x c **(1)**<br>c = 18.5 x 0.095 / 25 **(1)** | **(2)** |

**(Total for Question 3 = 11 marks)**

| Question Number | Answer | Acceptable answers | Marks |
|---|---|---|---|
| 4 (a)(i) | An explanation linking<br>• carbon dioxide/$CO_2$ (1)<br>• carbonate/$CO_3^{2-}$ (1) | mark independently<br><br>hydrogencarbonate/$HCO_3^-$<br><br>allow 'copper carbonate' for MP2 | **(2)** |

| Question Number | Answer | Acceptable answers | Marks |
|---|---|---|---|
| 4 (a)(ii) | copper hydroxide / $Cu(OH)_2$ (1) | reject copper oxide, CuO, $CuOH_2$<br>C, O, H must be capital letters<br>u must be small letter<br>must have brackets around OH<br>2 must be subscript – reject Cu(OH)2 or $Cu(OH)^2$ | **(1)** |

| Question Number | Answer | Acceptable answers | Marks |
|---|---|---|---|
| 4 (a)(iii) | $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$<br><br>correct formulae with no others on LHS (1)<br>correct formula with no others on RHS (1)<br><br>fully correct balanced ionic equation with correct state symbols (1) | allow +2 and -2 only<br><br>penalise incorrect use of capital / small letters or subscripts but not for MP3<br><br>allow = for →, multiples | **(3)** |

| Question Number | Answer | Acceptable answers | Marks |
|---|---|---|---|
| 4 (b) | An description including<br><br>WITH SILVER NITRATE<br>• add silver nitrate (solution) (1)<br>• chloride: white precipitate (1)<br>• bromide: cream / **pale** yellow precipitate (1)<br>• iodide: yellow precipitate (1)<br><br>WITH CHLORINE (WATER)<br>• add chlorine (1)<br>• chloride: no change (1)<br>• bromide: goes yellow/ orange (1)<br>• iodide: goes yellow /brown or black ppt (1) | if no silver nitrate, scores 0.<br>ignore anything else added to silver nitrate<br>allow ppt(e) /solid<br>penalise missing 'ppt' once only<br>do not penalise:<br>chlorine / Cl/ $Cl_2$ / $Cl^-$ ⇒ white ppt (same for bromide, iodide)<br><br>If no chlorine = 0.<br><br>bromide and iodide colours must be different | **(4)** |

**(Total for Question 4 = 10 marks)**

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **5 (a)(i)** | An explanation linking<br>• (equilibrium) shifts left / backwards / to reactants **(1)**<br>• because reverse reaction is endothermic / absorbs heat / lowers temperature **(1)** | Ignore any mention of rate / collisions<br>mark independently<br>statements like 'increase in temp shifts to endothermic direction' scores MP2 only | **(2)** |

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **5 (a)(ii)** | An explanation linking<br>• (equilibrium) shifts right / forwards / to products **(1)**<br>• because fewer molecules on right / 3 molecules on L but 2 on R / to reduce pressure **(1)** | Ignore any mention of rate / collisions<br>mark independently<br>allow 'to reduce volume'<br>moles/ particles = molecules | **(2)** |

| Question | Answers | Mark |
|---|---|---|
| **5 (a)(iii)** | **D** increases increases<br>**The only correct answer is D**<br>**A** is not correct because both rates increase<br>**B** is not correct because both rates increase<br>**C** is not correct because both rates increase | **(1)** |

| Question Number | Answers | Mark |
|---|---|---|
| **5 (b)** | **C** 10 35 20<br>**The only correct answer is C**<br>**A** is not correct because the oxygen volume is doubled<br>**B** is not correct because the ration 1: 14: 4 is incorrect<br>**D** is not correct because the ethane volume is halved | **(1)** |

| Question | | Indicative content | Mark |
|---|---|---|---|
| **QWC** | **5(c)** | A description including some of the following points<br><br>• use balance to find mass of the magnesium ribbon (0.048g)<br>• check the gas syringe is reading 0 ($cm^3$)<br>• pour the (sulfuric) acid into the flask<br>• add the magnesium to the acid<br>• connect syringe<br>• when all the magnesium has {reacted/disappeared/no further increase in volume of gas }<br>• record the {final/maximum} volume of {hydrogen/gas ($48cm^3$)}<br><br>• divide mass of magnesium by {24/relative atomic mass/$A_r$} to find number of moles Mg<br>• 0.048/24 = 0.002 mol Mg<br>• the same number of moles of hydrogen is produced / mole ratio magnesium : hydrogen is 1:1 / 1 mole of magnesium produces 1 mole of hydrogen<br>• 0.002 mol hydrogen produced<br>• divide volume of hydrogen collected by number of moles of hydrogen (to find volume of 1 mole)<br>• volume of 1 mole hydrogen = 48/0.002 = 24000 $cm^3$ | **(6)** |
| Level | 0 | No rewardable material | |
| **1** | **1-2** | • a limited description e.g. add the magnesium to the acid in the flask and measure gas volume OR relate mass of magnesium to volume of hydrogen<br>• the answer communicates ideas using simple language and uses limited scientific terminology<br>• spelling, punctuation and grammar are used with limited accuracy | |
| **2** | **3-4** | • a description of obtaining or using the results e.g. weigh then add the magnesium to the acid and stopper the flask, record the final volume of gas<br>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately.<br>• spelling, punctuation and grammar are used with some accuracy | |
| **3** | **5-6** | • a detailed description of obtaining and using the results e.g. find mass of magnesium and add it to the acid, record the final volume of gas, find the number of moles of magnesium by dividing the mass by 24 then divide the volume of hydrogen by the number of moles<br>• the answer communicates ideas clearly and coherently and uses scientific terminology accurately.<br>• spelling, punctuation and grammar are used with few errors | |

**(Total for Question 5 = 12 marks)**

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **6 (a)(i)** | {loss / removal} of electrons | ignore 'reduction of electrons' | **(1)** |

| Question Number | Answers | Mark |
|---|---|---|
| **6 (a)(ii)** | C $AgNO_3$<br><br>**The only correct answer is C**<br><br>**A** is not correct because there is one too few O<br><br>**B** is not correct because there is one too many Ag<br><br>**D** is not correct because there is one too many nitrate | **(1)** |

| Question Number | Answers | Acceptable Answers | Mark |
|---|---|---|---|
| **6 (b)** | An explanation linking<br><br>CATHODE<br>• copper (atoms) deposited / plated / gained /<br>copper **ions** gain electrons / copper **ions** reduced/ $Cu^{2+} + 2e^- \rightarrow Cu$ / copper **ions** go to cathode (1)<br><br>ANODE<br>• copper (atoms/ions) removed / dissolve<br>copper (atoms) lose electrons / copper (atoms) oxidised /<br>$Cu \rightarrow Cu^{2+} + 2e^-$ (1)<br><br>SOLID DEPOSIT<br>• impurities / sludge / gold / silver (fall from anode) (1)<br><br>COLOUR OF SOLUTION<br>• (blue) copper (ions) do not change in number or concentration / copper (ions) enter and leave solution (at same rate) / copper (ions) leave at cathode but enter at anode (1) | words in **bold** must be present<br><br>(words in brackets) need not be present but must not be contradicted | **(4)** |

| Question Number | | Indicative content | Mark |
|---|---|---|---|
| **QWC** | **6(c)** | An explanation including some of the following points:<br><br>in molten sodium chloride<br>• ions present: sodium ions / $Na^+$, chloride ions / $Cl^-$<br>• sodium ions attracted/migrate to negative electrode/cathode<br>• sodium ions gain eletrons / are reduced<br>• sodium produced at negative electrode/cathode / $Na^+ + e^- \rightarrow Na$<br>• chloride ions attracted/migrate to positive electrode/anode<br>• chloride ions lose electrons / are oxidised<br>• chlorine produced at positive electrode/anode / $2Cl^- - 2e^- \rightarrow Cl_2$ / $2Cl^- \rightarrow Cl_2 + 2e^-$<br><br>whereas in aqueous sodium chloride<br>• ions present (from sodium chloride): sodium ions / $Na^+$, chloride ions / $Cl^-$<br>• ions present (from water): hydrogen ions / $H^+$, hydroxide ions / $OH^-$<br>• hydrogen ions attracted/migrate to negative electrode/cathode<br>• hydrogen ions gain electrons / are reduced<br>• hydrogen produced at negative electrode/cathode / $2H^+ + 2e^- \rightarrow H_2$<br>• chloride ions attracted/migrate to positive electrode/anode<br>• chloride ions lose electrons / are oxidised<br>• chlorine produced at positive electrode/anode<br>• amount of chlorine depends on concentration of solution / $2Cl^- \rightarrow Cl_2 + 2e^-$<br>• sodium hydroxide remains in solution | **(6)** |

| Level | 0 | No rewardable material |
|---|---|---|
| **1** | **1-2** | • a limited explanation e.g. sodium and chlorine are produced from molten sodium chloride<br>• the answer communicates ideas using simple language and uses limited scientific terminology<br>• spelling, punctuation and grammar are used with limited accuracy |
| **2** | **3-4** | • a simple explanation e.g. in molten sodium chloride ions present: $Na^+$ and $Cl^-$ , sodium produced at cathode and chlorine produced at anode<br>• the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately.<br>• spelling, punctuation and grammar are used with some accuracy |
| **3** | **5-6** | • a detailed explanation including reference to both molten and aqueous sodium chloride e.g. a full explanation of one electrolyte and a limited explanation of the other<br>• the answer communicates ideas clearly and coherently and uses scientific terminology accurately.<br>• spelling, punctuation and grammar are used with few errors |

**(Total for Question 6 = 12 marks)**

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