



# Mark Scheme (Results)

Summer 2018

Pearson Edexcel International GCSE  
In Chemistry (4CH0) Paper 2C

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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   | Notes  | Marks |
|-----------------|--|--|-------|
| 1 (a)           | <b>M1</b> carbon<br><b>M2</b> hydrogen               | <b>ACCEPT</b> C<br><b>ACCEPT</b> H / H <sub>2</sub><br>For M1 and M2, if name and symbol/formula given both must be correct                            | 2     |
| (b)             | oxygen   | <b>ACCEPT</b> O <sub>2</sub><br><b>IGNORE</b> O  | 1     |
| (c) (i)         | <b>M1</b> carbon dioxide<br><b>M2</b> water (vapour) | <b>ACCEPT</b> CO <sub>2</sub><br><b>ACCEPT</b> H <sub>2</sub> O<br><b>ALLOW</b> steam<br>For M1 and M2, if name and formula given both must be correct | 2     |
| (ii)            | carbon monoxide                                      | <b>ACCEPT</b> CO<br>If name and formula given both must be correct   | 1     |

**Total for Question 1 = 6**

| Question number | Answer   | Notes  | Marks                 |   |  |   |          |   |          |   |          |   |   |
|-----------------|--|--|-----------------------|---|--|---|----------|---|----------|---|----------|---|---|
| 2 (a)           | <table border="1"> <thead> <tr> <th>Fuel</th> <th>Change in temperature</th> </tr> </thead> <tbody> <tr> <td>W</td> <td></td> </tr> <tr> <td>X</td> <td>(+) 10.3</td> </tr> <tr> <td>Y</td> <td>(+) 15.9</td> </tr> <tr> <td>Z</td> <td>(+) 11.1</td> </tr> </tbody> </table>              | Fuel   | Change in temperature | W |  | X | (+) 10.3 | Y | (+) 15.9 | Z | (+) 11.1 | <p>All three must be correct</p> <p><b>IGNORE</b> trailing zeroes</p> | 1 |
| Fuel            | Change in temperature  |  |                       |   |  |   |          |   |          |   |          |   |   |
| W               |  |  |                       |   |  |   |          |   |          |   |          |   |   |
| X               | (+) 10.3   |  |                       |   |  |   |          |   |          |   |          |   |   |
| Y               | (+) 15.9   |  |                       |   |  |   |          |   |          |   |          |   |   |
| Z               | (+) 11.1   |  |                       |   |  |   |          |   |          |   |          |   |   |
| (b)             | <p><b>M1</b> fuel Y</p> <p><b>M2</b> (because it produces the largest temperature rise/increase)</p>   | <p>ECF on temperature changes recorded in table</p> <p><b>ACCEPT</b> (because it produces the) largest temperature change</p> <p><b>IGNORE</b> reaches the highest final temperature</p> | 2                     |   |  |   |          |   |          |   |          |   |   |
| (c)             | <p>C (exothermic)</p> <p>A is incorrect as decomposition is not the name given to reactions that release heat energy</p> <p>B is incorrect as endothermic reactions take in heat energy</p> <p>D is incorrect as reduction is not the name given to reactions that release heat energy</p> |  | 1                     |   |  |   |          |   |          |   |          |   |   |

**Total for Question 2 = 4**

| Question number               | Answer                       |                 |         |       |       |       | Notes  | Mark |  |
|-------------------------------|------------------------------|-----------------|---------|-------|-------|-------|--|------|--|
| 3 (a) (i)                     | <b>Burette reading after</b> |                 | (20.80) |       |       |       | Mark <b>M2</b> CQ on <b>M1</b><br><br>If the answers are in the wrong order allow 1 mark | 2    |  |
| <b>Burette reading before</b> |                              | 3.15            |         |       |       |       |  |      |  |
| <b>Volume of acid added</b>   |                              | 17.65           |         |       |       |       |  |      |  |
| <b>M1</b> 3.15                |                              | <b>M2</b> 17.65 |         |       |       |       |  |      |  |
| (b) (i)                       | <b>Volume of acid added</b>  | 26.25           | 25.10   | 25.75 | 25.30 | 25.20 | All three columns must contain ticks   | 1    |  |
| <b>Concordant results</b>     |                              |                 | ✓       |       | ✓     | ✓     |  |      |  |

| Question number | Answer  | Notes  | Mark |
|-----------------|---------|--|------|
| 3 (b) (ii)      | 25.2(0) | <p>CQ on any combination of ticked results rounded correctly</p> <p>If no results are ticked then the mark can only be awarded for 25.2(0)</p> <p>If only one column ticked then no mark can be awarded in (b)(ii)</p> <p><b>ALLOW</b> any number of figures after the decimal point, but answer must be given to at least one decimal place</p> | 1    |

**Total for Question 3 =4**

| Question number | Answer   | Notes  | Marks |
|-----------------|--|--|-------|
| 4 (a)           | <b>C</b> (fluorine)<br><br>A is incorrect as bromine is not the most reactive element. It is not as reactive as fluorine<br><br>B is incorrect as chlorine is not the most reactive element. It is not as reactive as fluorine<br><br>D is incorrect as iodine is the least reactive element of the four |  | 1     |
| (b)             | <b>D</b> (iodine)<br><br>A is incorrect as bromine is a liquid at room temperature<br><br>B is incorrect as chlorine is a gas at room temperature<br><br>C is incorrect as fluorine is a gas at room temperature   |  | 1     |
| (c)             | <b>D</b> (iodine)<br><br>A is incorrect as bromine is brown and not as dark as iodine, which is dark grey<br><br>B is incorrect as chlorine is pale green<br><br>C is incorrect as fluorine is pale yellow   |  | 1     |
| (d)             | <b>M1</b> $\Sigma(\text{bonds broken}) = 436 + 193$<br><br><b>OR</b> 629 (kJ/mol)<br><br><b>M2</b> $\Sigma(\text{bonds made}) = 2 \times 366$<br><br><b>OR</b> 732 (kJ/mol)<br><br><b>M3</b> $\Delta H = -103$ (kJ/mol)<br><b>OR</b><br><br><b>M1 – M2</b> evaluated correctly with the correct sign     | <b>IGNORE</b> any signs in M1 and M2<br><br><br><br>negative sign required<br><br>–103 with or without working scores 3<br><br>(+)103 with or without working scores 2 | 3     |

**Total for Question 4 = 6**



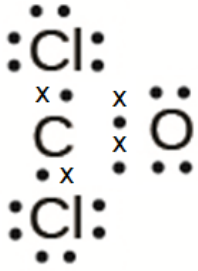
| Question number | Answer   | Notes  | Marks |
|-----------------|--|--|-------|
| 5 (a) (i)       | Yeast  | <b>ALLOW</b> zymase<br><b>IGNORE</b> enzyme(s)   | 1     |
| (ii)            | $(C_{12}H_{22}O_{11} + H_2O \rightarrow) 2 C_6H_{12}O_6$   | <b>ACCEPT</b> multiples and fractions<br><br><b>IGNORE</b> state symbols even if incorrect   | 1     |
| (iii)           | $C_6H_{12}O_6 \rightarrow 2 C_2H_5OH + 2 CO_2$   | <b>ACCEPT</b> multiples and fractions<br><br><b>IGNORE</b> state symbols even if incorrect<br><br><b>ALLOW</b> $C_2H_6O$ for ethanol | 1     |
| (iv)            | <b>C</b> (fractional distillation)<br><br>A is incorrect as you could not obtain ethanol by crystallisation<br><br>B is incorrect as you could not obtain ethanol by filtration<br><br>D is incorrect as simple distillation is not the most effective way to obtain ethanol |  | 1     |

| Question number | Answer  | Notes  | Marks |
|-----------------|---|--|-------|
| 5 (b) (i)       | phosphoric acid   | <p><b>ACCEPT</b> H<sub>3</sub>PO<sub>4</sub><br/>If both name and formula given, mark name only</p> <p><b>REJECT</b> phosphorus acid</p> <p><b>IGNORE</b> reference to concentration</p>   | 1     |
| (ii)            | <p><b>M1</b> 300 ( °C)</p> <p><b>M2</b> 60–70 (atm)</p> | <p><b>ACCEPT</b> any temperature, or range of temperatures, between 250 and 350 inclusive</p> <p><b>ACCEPT</b> temperatures in other units provided unit is given</p> <p><b>ACCEPT</b> any pressure or range of pressures between 60 and 70 inclusive</p> <p><b>ACCEPT</b> pressures in other units provided unit is given e.g. 6 x 10<sup>6</sup> Pa to 7 x 10<sup>6</sup> Pa</p> | 2     |

| Question number | Answer   | Notes   | Marks |
|-----------------|--|---|-------|
| (c) (i)         | dehydration  | <b>ACCEPT</b> (thermal) decomposition/elimination   | 1     |
| (ii)            | (to act as a) catalyst                                   | <b>ACCEPT</b> to increase the rate of reaction<br><br><b>IGNORE</b> to lower the activation energy<br><br><b>IGNORE</b> references to increased surface area  | 1     |
| (d) (i)         | (contains a carbon to carbon) double bond / C=C          | <b>ALLOW</b> multiple bond  | 1     |
| (ii)            | <b>M1</b> (from) orange<br><br><b>M2</b> (to) colourless | <b>ACCEPT</b> brown/yellow or any combination of orange/brown/yellow e.g. orange-brown<br><br><b>REJECT</b> red<br><br><b>IGNORE</b> clear<br><br><b>ALLOW</b> decolourised<br><br><b>REJECT</b> discoloured<br><br>Award 1 mark for two correct answers in wrong order | 2     |

**Total for Question 5 = 12**

| Question number | Answer  | Notes  | Marks |
|-----------------|---|--|-------|
| 6 (a) (i)       | <p><b>M1</b> the equilibrium shifts to the left (as temperature increases)</p> <p><b>M2</b> (because the forward) reaction is exothermic/ releases heat (energy)/ releases thermal energy</p> | <p><b>ALLOW</b> the reaction moves in the backwards direction OWTTE</p> <p><b>IGNORE</b> changes in amounts of reactants and products e.g. less phosgene/more CO and Cl<sub>2</sub> produced</p> <p><b>ACCEPT</b> (because the) backward reaction is endothermic/ takes in heat (energy)/takes in thermal energy</p> <p><b>IGNORE</b> references to Le Chatelier's principle, eg favours the reaction that tries to reduce the temperature/ favours the backward reaction</p> <p><b>M2</b> dep on <b>M1</b> correct or missing</p> | 2     |
| (ii)            | <p><b>M1</b> (yield) increases / the amount of phosgene increases</p> <p><b>M2</b> as there are fewer moles/molecules (of gas) on the right</p>   | <p><b>ACCEPT</b> there are fewer moles/molecules of product</p> <p><b>ACCEPT</b> reverse argument</p> <p><b>ALLOW</b> particles</p> <p><b>REJECT</b> atoms</p> <p><b>IGNORE</b> references to Le Chatelier's principle, eg favours the reaction with more moles (of gas)</p> <p><b>M2</b> dep on <b>M1</b></p>   | 2     |
| (b)             | $\text{COCl}_2 + \text{H}_2\text{O} \rightarrow 2 \text{HCl} + \text{CO}_2$   | <p><b>ACCEPT</b> multiples and fractions</p> <p><b>IGNORE</b> state symbols even if incorrect</p>  | 1     |

| Question number | Answer  | Notes  | Marks |
|-----------------|---|--|-------|
| 6 (c)           |  <p><b>M1</b> both bond pairs for C–Cl correct</p> <p><b>M2</b> bond pairs for C=O correct</p> <p><b>M3</b> all non-bonded electrons correct</p> | <p><b>ACCEPT</b> any combination of dots and crosses</p> <p><b>IGNORE</b> inner shells even if incorrect</p> <p><b>M3</b> dep on <b>M1</b> and <b>M2</b> correct</p> | 3     |

**Total for Question 6 = 8**

| Question number | Answer  | Notes   | Marks |
|-----------------|---|---|-------|
| 7 (a)           | carbon dioxide/gas escapes (from the crucible)/is given off/is lost/is released   | <b>REJECT</b> incorrectly named gas<br><b>IGNORE</b> carbon dioxide is formed<br><b>REJECT</b> references to evaporation  | 1     |
| (b) (i)         | to check that the magnesium carbonate has fully decomposed  | <b>ALLOW</b> to make sure <b>all</b> (the magnesium carbonate) has reacted/the reaction is complete OWTTE<br><b>ALLOW</b> to make sure <b>all</b> the gas/carbon dioxide has been given off<br><b>IGNORE</b> the reaction has stopped | 1     |
| (ii)            | <b>M1</b> (expt) 1<br><b>M2</b> (because the) mass is not constant (after heating for 15 minutes)/mass at 15 minutes is different from the mass at 10 minutes<br><b>OR</b><br>the mass is still changing (after heating for 15 minutes) | ALLOW weight for mass<br><br>M2 dep on M1   | 2     |

**Total for Question 7 = 4**

| Question number | Answer  | Notes   | Marks |
|-----------------|---|---|-------|
| 8 (a)           | <p><b>M1</b> <math>0.0968 \times 0.1(00)</math></p> <p><b>OR</b> <math>\frac{0.0968 \times 100}{1000}</math></p> <p><b>M2</b> <math>0.00968</math> (mol)</p>  | <p><b>ACCEPT</b> 0.0097<br/> <b>REJECT</b> 0.01<br/> <b>ALLOW</b> 9.68/9.7 for 1 mark</p> <p>Correct final answer without working scores both marks</p> | 2     |
| (b)             | <p><b>M1</b> <math>0.29 \div 58</math></p> <p><b>M2</b> <math>0.005(0)</math> (mol)</p>   | Correct final answer without working scores both marks  | 2     |
| (c)             | <p><b>M1</b> Yes (he used the right amount of magnesium hydroxide) / no he used too much (magnesium hydroxide)</p> <p><b>M2</b> 1 mol <math>\text{Mg(OH)}_2</math> reacts with/neutralises 2 mol HCl</p> <p><b>OR</b> 0.005 mol <math>\text{Mg(OH)}_2</math> reacts with/neutralises 0.01 mol HCl</p> <p><b>OR</b> 0.00968 mol HCl reacts with/is neutralised by 0.00484 mol <math>\text{Mg(OH)}_2</math></p> | <p><b>ACCEPT</b> He needs 0.00484 mol <math>\text{Mg(OH)}_2</math></p>  | 2     |

**Total for Question 8 = 6**

| Question number | Answer   | Notes  | Marks |
|-----------------|--|--|-------|
| 9 (a) (i)       | <p><b>M1</b> (<math>\rightleftharpoons</math>) (the reaction is) reversible</p> <p><b>M2</b> (<math>\Delta H</math>) (molar) enthalpy change (of reaction)</p> | <p><b>ACCEPT</b> reaction goes both ways/both forward and backward reactions can occur</p> <p><b>IGNORE</b> equilibrium</p> <p><b>ACCEPT heat</b> (energy) change/<b>thermal</b> energy change</p> <p><b>IGNORE</b> enthalpy alone</p> <p><b>REJECT</b> temperature change</p>   | 2     |
| (ii)            | vanadium(V) oxide / vanadium pentoxide   | <p><b>ACCEPT</b> vanadium oxide</p> <p><b>ACCEPT</b> <math>V_2O_5</math></p> <p><b>REJECT</b> vanadium in any other oxidation state</p> <p><b>IGNORE</b> incorrect formula</p>   | 1     |
| (iii)           | <p><b>M1</b> (temperature) 450 (<math>^{\circ}C</math>)</p> <p><b>M2</b> (pressure) 2 (atm)</p>  | <p><b>ACCEPT</b> any temperature, or range of temperatures, between 400 to 500 inclusive</p> <p><b>ACCEPT</b> temperature in other units provided unit is given</p> <p><b>ACCEPT</b> any pressure, or range of pressures, between 1 and 5 (atm) inclusive</p> <p><b>ACCEPT</b> pressure in other units provided unit is given e.g. <math>1 \times 10^5</math> to <math>5 \times 10^5</math> Pa</p> | 2     |



| Question number | Answer   | Notes  | Marks |
|-----------------|--|--|-------|
| 9 (b) (i)       | a (corrosive) mist/cloud/fog/spray/ fumes (of sulfuric acid) would be formed (above the mixture)   | <p><b>ACCEPT</b> the reaction generates a lot of/too much heat/is <b>too</b> exothermic</p> <p><b>ACCEPT</b> the mixture gets very/too hot/forms steam</p> <p><b>IGNORE</b> very exothermic</p> <p><b>IGNORE</b> too dangerous/explosive</p> | 1     |
| (ii)            | <p><b>M1</b> (step 3) <math>\text{H}_2\text{SO}_4 + \text{SO}_3 \rightarrow \text{H}_2\text{S}_2\text{O}_7</math></p> <p><b>M2</b> (step 4) <math>\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow 2 \text{H}_2\text{SO}_4</math></p> | <p><b>ACCEPT</b> multiples</p> <p><b>ACCEPT</b> multiples and fractions</p>  | 2     |

| Question number | Answer  | Notes  | Marks |
|-----------------|---|--|-------|
| (c)             | Any two from:<br><br><b>M1</b> manufacture of/making detergents/ soaps<br><br><b>M2</b> manufacture of/making fertilisers<br><br><b>M3</b> manufacture of/making paints/ pigments/dyes<br><br><b>M4</b> manufacture of/making polymers/ plastics/ fibres<br><br><b>M5</b> pickling of steel / cleaning metals<br><br><b>M6</b> manufacture of/making explosives<br><br><b>M7</b> manufacture of/making paper<br><br><b>M8</b> in car batteries/battery acid | If they have not mentioned manufacture or making give MAX 1 for two correct uses.<br><br><b>IGNORE</b> used to manufacture sulphuric acid in the Contact Process | 2     |

**Total for Question 9 = 10**

