



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)	M1 carbon M2 hydrogen	ACCEPT C ACCEPT H / H ₂ For M1 and M2, if name and symbol/formula given both must be correct	2
(b)	oxygen	ACCEPT O ₂ IGNORE O	1
(c) (i)	M1 carbon dioxide M2 water (vapour)	ACCEPT CO ₂ ACCEPT H ₂ O ALLOW steam For M1 and M2, if name and formula given both must be correct	2
(ii)	carbon monoxide	ACCEPT CO 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>IGNORE trailing zeroes</p>	1
Fuel	Change in temperature												
W													
X	(+) 10.3												
Y	(+) 15.9												
Z	(+) 11.1												
(b)	<p>M1 fuel Y</p> <p>M2 (because it produces the largest temperature rise/increase)</p>	<p>ECF on temperature changes recorded in table</p> <p>ACCEPT (because it produces the) largest temperature change</p> <p>IGNORE 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)	<table border="1" data-bbox="416 510 928 734"> <tr> <td>Burette reading after</td> <td>(20.80)</td> </tr> <tr> <td>Burette reading before</td> <td>3.15</td> </tr> <tr> <td>Volume of acid added</td> <td>17.65</td> </tr> </table> <p data-bbox="416 801 564 837">M1 3.15</p> <p data-bbox="416 875 572 911">M2 17.65</p>	Burette reading after	(20.80)	Burette reading before	3.15	Volume of acid added	17.65	<p data-bbox="1078 875 1270 947">Mark M2 CQ on M1</p> <p data-bbox="1078 981 1273 1160">If the answers are in the wrong order allow 1 mark</p>	2						
Burette reading after	(20.80)														
Burette reading before	3.15														
Volume of acid added	17.65														
(b) (i)	<table border="1" data-bbox="416 1234 1048 1552"> <tr> <td>Volume of acid added</td> <td>26.25</td> <td>25.10</td> <td>25.75</td> <td>25.30</td> <td>25.20</td> </tr> <tr> <td>Concordant results</td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td>✓</td> </tr> </table>	Volume of acid added	26.25	25.10	25.75	25.30	25.20	Concordant results		✓		✓	✓	<p data-bbox="1078 1234 1273 1373">All three columns must contain ticks</p>	1
Volume of acid added	26.25	25.10	25.75	25.30	25.20										
Concordant results		✓		✓	✓										

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

Total for Question 4 = 6

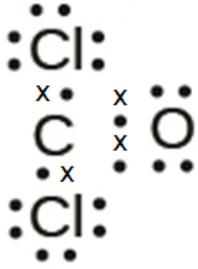
Question number	Answer	Notes	Marks
5 (a) (i)	Yeast	ALLOW zymase IGNORE enzyme(s)	1
(ii)	$(C_{12}H_{22}O_{11} + H_2O \rightarrow) 2 C_6H_{12}O_6$	ACCEPT multiples and fractions IGNORE state symbols even if incorrect	1
(iii)	$C_6H_{12}O_6 \rightarrow 2 C_2H_5OH + 2 CO_2$	ACCEPT multiples and fractions IGNORE state symbols even if incorrect ALLOW C_2H_6O for ethanol	1
(iv)	C (fractional distillation) A is incorrect as you could not obtain ethanol by crystallisation B is incorrect as you could not obtain ethanol by filtration 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>ACCEPT H₃PO₄ If both name and formula given, mark name only</p> <p>REJECT phosphorus acid</p> <p>IGNORE reference to concentration</p>	1
(ii)	<p>M1 300 (°C)</p> <p>M2 60–70 (atm)</p>	<p>ACCEPT any temperature, or range of temperatures, between 250 and 350 inclusive</p> <p>ACCEPT temperatures in other units provided unit is given</p> <p>ACCEPT any pressure or range of pressures between 60 and 70 inclusive</p> <p>ACCEPT pressures in other units provided unit is given e.g. 6 x 10⁶ Pa to 7 x 10⁶ Pa</p>	2

Question number	Answer	Notes	Marks
(c) (i)	dehydration	ACCEPT (thermal) decomposition/elimination	1
	(ii) (to act as a) catalyst	ACCEPT to increase the rate of reaction IGNORE to lower the activation energy IGNORE references to increased surface area	1
(d) (i)	(contains a carbon to carbon) double bond / C=C	ALLOW multiple bond	1
	(ii) M1 (from) orange M2 (to) colourless	ACCEPT brown/yellow or any combination of orange/brown/yellow e.g. orange-brown REJECT red IGNORE clear ALLOW decolourised REJECT discoloured 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>M1 the equilibrium shifts to the left (as temperature increases)</p> <p>M2 (because the forward) reaction is exothermic/ releases heat (energy)/ releases thermal energy</p>	<p>ALLOW the reaction moves in the backwards direction OWTTE</p> <p>IGNORE changes in amounts of reactants and products e.g. less phosgene/more CO and Cl₂ produced</p> <p>ACCEPT (because the) backward reaction is endothermic/ takes in heat (energy)/takes in thermal energy</p> <p>IGNORE references to Le Chatelier's principle, eg favours the reaction that tries to reduce the temperature/ favours the backward reaction</p> <p>M2 dep on M1 correct or missing</p>	2
(ii)	<p>M1 (yield) increases / the amount of phosgene increases</p> <p>M2 as there are fewer moles/molecules (of gas) on the right</p>	<p>ACCEPT there are fewer moles/molecules of product</p> <p>ACCEPT reverse argument</p> <p>ALLOW particles</p> <p>REJECT atoms</p> <p>IGNORE references to Le Chatelier's principle, eg favours the reaction with more moles (of gas)</p> <p>M2 dep on M1</p>	2
(b)	$\text{COCl}_2 + \text{H}_2\text{O} \rightarrow 2 \text{HCl} + \text{CO}_2$	<p>ACCEPT multiples and fractions</p> <p>IGNORE state symbols even if incorrect</p>	1

Question number	Answer	Notes	Marks
6 (c)	 <p>M1 both bond pairs for C—Cl correct</p> <p>M2 bond pairs for C=O correct</p> <p>M3 all non-bonded electrons correct</p>	<p>ACCEPT any combination of dots and crosses</p> <p>IGNORE inner shells even if incorrect</p> <p>M3 dep on M1 and M2 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	REJECT incorrectly named gas IGNORE carbon dioxide is formed REJECT references to evaporation	1
(b) (i)	to check that the magnesium carbonate has fully decomposed	ALLOW to make sure all (the magnesium carbonate) has reacted/the reaction is complete OWTTE ALLOW to make sure all the gas/carbon dioxide has been given off IGNORE the reaction has stopped	1
(ii)	M1 (expt) 1 M2 (because the) mass is not constant (after heating for 15 minutes)/mass at 15 minutes is different from the mass at 10 minutes OR the mass is still changing (after heating for 15 minutes)	ALLOW weight for mass M2 dep on M1	2

Total for Question 7 = 4

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

Total for Question 8 = 6

Question number	Answer	Notes	Marks
9 (a) (i)	<p>M1 (\rightleftharpoons) (the reaction is) reversible</p> <p>M2 (ΔH) (molar) enthalpy change (of reaction)</p>	<p>ACCEPT reaction goes both ways/both forward and backward reactions can occur</p> <p>IGNORE equilibrium</p> <p>ACCEPT heat (energy) change/thermal energy change</p> <p>IGNORE enthalpy alone</p> <p>REJECT temperature change</p>	2
(ii)	vanadium(V) oxide / vanadium pentoxide	<p>ACCEPT vanadium oxide</p> <p>ACCEPT V_2O_5</p> <p>REJECT vanadium in any other oxidation state</p> <p>IGNORE incorrect formula</p>	1
(iii)	<p>M1 (temperature) 450 ($^{\circ}C$)</p> <p>M2 (pressure) 2 (atm)</p>	<p>ACCEPT any temperature, or range of temperatures, between 400 to 500 inclusive</p> <p>ACCEPT temperature in other units provided unit is given</p> <p>ACCEPT any pressure, or range of pressures, between 1 and 5 (atm) inclusive</p> <p>ACCEPT pressure in other units provided unit is given e.g. 1×10^5 to 5×10^5 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>ACCEPT the reaction generates a lot of/too much heat/is too exothermic</p> <p>ACCEPT the mixture gets very/too hot/forms steam</p> <p>IGNORE very exothermic</p> <p>IGNORE too dangerous/explosive</p>	1
(ii)	<p>M1 (step 3) $\text{H}_2\text{SO}_4 + \text{SO}_3 \rightarrow \text{H}_2\text{S}_2\text{O}_7$</p> <p>M2 (step 4) $\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow 2 \text{H}_2\text{SO}_4$</p>	<p>ACCEPT multiples</p> <p>ACCEPT multiples and fractions</p>	2

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

Total for Question 9 = 10

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