Mark Scheme (Results)

January 2020

Pearson Edexcel International GCSE in Chemistry (4CH1)
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)	potassium	**ALLOW** K	1
(b)	(paper) chromatography		1
			1
(c) (i)	sodium chloride	**ALLOW** NaCl	1
(ii)	air		1
(iii)	sulfur	**ALLOW** S	
			Total 5

Question number	Answer	Notes	Marks
2 (a)	fractional distillation	**ACCEPT** fractionation/fractionating **IGNORE** distillation alone	1 1
(b)	aircraft fuel/jet fuel/paraffin or fuel for lamps/ heaters	**ALLOW** heating oil **ALLOW** cooking fuel	
(c) (i)	butane	Spelling must be correct	1
(ii)	(M_r = 4 x 12 + 10 x 1 =) 58		1
(d) (i)	C_7H_{16}		1
(ii)	C_nH_{2n+2}	**ACCEPT** different letters to n / uppercase	1

Question number	Answer	Notes	Marks
2 (e) (i)	alumina / silica	**ACCEPT** aluminium oxide / silicon dioxide / Al_2O_3 / SiO_2 / zeolite(s) / aluminosilicate(s)	1
(ii)	An explanation that links the following two points **M1** greater demand for short chain alkanes (than long chain alkanes) **M2** more long-chain alkanes than are needed / too great a supply of /surplus of long-chain alkanes **OR** not enough short chain alkanes to meet demands	**ALLOW** short chain alkanes are more useful (than long chain alkanes) **ALLOW** short chain alkanes needed for specific uses e.g. petrol	2
(f)	$(C_{11}H_{24} \rightarrow C_5H_{12})$ + C_2H_4 + C_4H_8 **M1** C_2H_4 **M2** C_4H_8	alkenes can be in either order **ALLOW** 1 mark for C_6H_{12} / $2C_3H_6$ / $C_3H_6 + C_3H_6$ **ALLOW** correct displayed formulae	2
			Total 11

Question number	Answer	Notes	Marks
3 (a)	An explanation that links the following two points **M1 e**lectrons are delocalised **M2** (electrons) can move/can flow/are mobile	 **IGNORE** sea of electrons /free electrons **REJECT** cations/atoms move for both marks **M2** dep on **M1** or mention of electrons i.e. 'electrons move' scores 1 mark	2
(b) (i)	**M1** brown/pink/pink-brown solid formed **M2** bubbles/fizzing/effervescence	**ACCEPT** brown/pink coating/deposit on the electrode **ALLOW** red-brown **REJECT** orange **REJECT** precipitate **ALLOW** 1 mark if both observations correct but at incorrect electrodes **IGNORE** gas produced /evolved/released **IGNORE** name of gas	2
(ii)	copper **ion(s)**/Cu^{2+} gains electrons	**ACCEPT** oxidation state of copper goes down / goes from +2 to 0 **IGNORE** references to loss of oxygen **ALLOW** electrons are gained **REJECT** copper/Cu gains electrons	1
(iii)	An explanation that links the following two points **M1** the (blue) colour is caused by copper **ions**/Cu^{2+} **M2** copper ions/Cu^{2+} are being discharged/ removed from the solution	 **ACCEPT** concentration of copper ions/Cu^{2+} decreases **ALLOW** copper ions/Cu^{2+} form copper	2

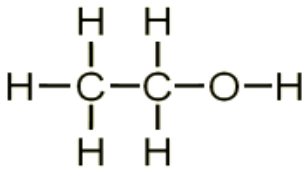
Question number	Answer	Notes	Marks
3 (c)	• calculate the mass of water removed • calculate the amount, in moles, of $CuSO_4$ • calculate the amount, in moles, of water • divide amount of H_2O by amount of $CuSO_4$ Example calculation **M1** (12.5 – 8.0) = 4.5 (g) **M2** $n(CuSO_4)$ = 8.0 ÷ 159.5 = 0.05(0) (mol) **M3** $n(H_2O)$ = 4.5 ÷ 18 = 0.25 (mol) **M4** 0.25 ÷ 0.05(0) (= 5)	**ACCEPT** alternative methods which show that the answer is 5	4 **Total 11**

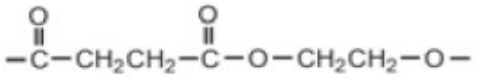
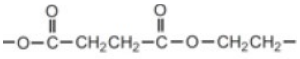
Question number	Answer	Notes	Marks
4 (a)	**M1** (from) yellow **M2** (to) orange	 **ACCEPT** red **ALLOW** pink 1 mark for two correct colours in the wrong order	2
(b)	A description that makes reference to any **four** of the following points **M1** he should not rinse flask with sodium hydroxide solution **or** he should rinse flask with water **M2** he should use a pipette to measure out the sodium hydroxide solution **M3** he should not rinse the burette with water **or** he should rinse the burette with sulfuric acid **M4** he should record the initial burette reading **M5** he should place a white tile under the flask **M6** he should swirl the flask whilst adding the acid **M7** he should add the acid dropwise near the end-point **M8** repeat the titration (to obtain an average/ concordant results)	 **ACCEPT** he should use a pipette instead of a measuring cylinder **ALLOW** white paper **IGNORE** stir	4

Question number	Answer	Notes	Marks
4 (c)	• calculate the amount, in moles, of sodium hydroxide • calculate the amount, in moles, of sulfuric acid • calculate the concentration of sulfuric acid Example calculation **M1** n(NaOH) = 0.0250 × 0.200 **or** 0.005 (mol) **M2** $n(H_2SO_4)$ = 0.005 ÷ 2 **or** 0.0025 (mol) **M3** conc^n = (0.0025 ÷ 0.0167) = 0.150 (mol/dm^3)	answer to **M1** ÷ 2 answer to **M2**÷0.0167 **ALLOW** 0.1497 or any number of sig fig except one Correct answer without working scores 3 **ACCEPT** alternative methods	3 **Total 9**

Question number	Answer	Notes	Marks
5 (a)	**B** it relights a glowing splint A is incorrect as this is the test for hydrogen C is incorrect as oxygen is not an acidic gas D is incorrect as this is the test for carbon dioxide		1
(b)	An explanation that links the following two points **M1** provides an alternative pathway OWTTE **M2** with a lower activation energy OWTTE	 **ACCEPT** more collisions with energy greater than the activation energy **ALLOW** lowers the energy needed to start the reaction	2

Question number	Answer	Notes	Marks
5 (c) (i)	• find energy needed to break bonds • find energy released when bonds form • correct subtraction to find ΔH Example calculation **M1** **(**4 x 463) + (2 x 143) **OR** 2138 (kJ) **M2** (4 x 463) + 498 **OR** 2350 (kJ) **M3** — 212 (kJ) **OR M1 – M2** correctly evaluated	 **ACCEPT** (2 x 143)/286 for **M1** and 498 for **M2** **IGNORE** any signs in **M1** and **M2** — 212 with or without working scores 3 (+) 212 with or without working scores 2	3
(ii)	Energy $2H_2O_2$ ΔH $2H_2O + O_2$ **M1** horizontal line to show products in correct position and correctly labelled **M2** vertical line in correct position and labelled ΔH	 Mark CQ on sign in (i) **ACCEPT** double headed arrow or arrow pointing from reactants level to products level **REJECT** arrow pointing from products level to reactants level **IGNORE** any attempts at including activation energy	2
			Total 8

Question number	Answer	Notes	Marks
6 (a) (i)	**M1** 300 (°C)	**ACCEPT** any temperature or range 250 to 350 inclusive. **ACCEPT** any correct alternative unit and quantity	2
	M2 60 to 70 (atm)	**ACCEPT** any pressure or range 60 to 70 inclusive **ACCEPT** any correct alternative unit and quantity	
(ii)		All bonds including bond between O and H must be shown.	1
(b) (i)	$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$		2
	M1 all formulae correct	**ALLOW** C_2H_6O for ethanol	
	M2 balancing of correct formulae	**ACCEPT** multiples and fractions **IGNORE** state symbols even if incorrect **M2** dep on **M1**	
(ii)	prevents blood from carrying oxygen/ reduces the capacity of blood to carry oxygen OWTTE	**ALLOW** references to combining with haemoglobin in red blood cells or forming carboxyhaemoglobin	1

Question number	Answer	Notes	Marks
6 (c)	ethyl ethanoate	**ALLOW** ethyl acetate	1
(d) (i)	condensation (polymerisation)		1
(ii)	 + $2H_2O$ **M1** correct ester link **M2** rest of polymer structure correct with extension bonds **M3** $2H_2O$	**ACCEPT**  for **M1** and **M2** If brackets and n present equation must be fully balanced with n in front of each reactant and $2nH_2O$ for full marks, otherwise max 2 If dimer is drawn with OH at one end and COOH at the other a mark can be awarded for H_2O without the 2 as this equation is then balanced, so **M1** and **M3** can be awarded.	3 **Total 11**

Question number	Answer	Notes	Marks
7 (a) (i)	calcium + water → calcium hydroxide + hydrogen	**ACCEPT** fully correct balanced chemical equation. $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ **IGNORE** state symbols even if incorrect	1
(ii)	Any two from		2
	M1 effervescence/fizzing/bubbles	**IGNORE** gas given off	
	M2 calcium/metal/solid disappears/becomes smaller OWTTE	**ALLOW** calcium/metal /solid dissolves	
	M3 test tube/beaker feels warm/hot	**ALLOW** heat produced /temperature increases	
(b) (i)	A description that makes reference to the following five points		5
	M1 dissolve each of the solids in water/make a solution of each of the solids	**ALLOW M1** and **M2** if just one of the solids is dissolved in water and then the other solid is added to it.	
	M2 mix/add (the two solutions together)	**M2** dep on **M1** or on reference to the **solutions** being mixed	
	M3 filter (the mixture)	If implication is that filtering is to obtain crystals from the solution no **M3**	
	M4 wash the precipitate/solid/barium sulfate /salt/residue (with water)		
	M5 suitable method of drying the solid	e.g. dry in a (warm) oven/dry between filter papers **ALLOW** leave to dry **REJECT** hot oven or direct heating (with Bunsen burner) If evaporation of solution to form crystals do not award **M4** but allow **M5** for suitable drying method	

(ii)	$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ **M1** all formulae correct **M2** state symbols correct	If formulae incorrect or full equation given (even if incorrect) **M2** can still be awarded for correct state symbols. If NaCl in equation must be (aq).	2

Question number	Answer	Notes	Marks
7 (c) (i)	**C** decomposition A is incorrect as it is not an addition reaction B is incorrect as oxygen is not a reactant D is incorrect as nothing is neutralised here		1
(ii)	• calculate the amount, in moles, of magnesium nitrate • use the equation to find the total amount, in moles, of gas produced • multiply this amount by 24 • answer given to two significant figures Example calculation **M1** *n*(magnesium nitrate) = 7.7 ÷ 148 **or** 0.052 (mol) **M2** *n*(gas) = 5 x 0.052 ÷ 2 **or** 0.13 (mol) **M3** Total volume of gas = 0.13 x 24 **or** 3.12 **M4** 3.1(dm^3)	5 x answer to **M1** ÷2 answer to **M2** x 24 answer to **M3** to 2 sig fig Allow any number of sig fig for **M1**, **M2** and **M3** 3.1 without working scores 4 3.12 without working scores 3	4
			Total 15

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