



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	1
(b)	aircraft fuel/jet fuel/paraffin or fuel for lamps/ heaters	IGNORE distillation alone ALLOW heating oil ALLOW cooking fuel	1
(c) (i)	butane	Spelling must be correct	1
(ii)	$(M_r = 4 \times 12 + 10 \times 1 =) 58$		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)	<p>An explanation that links the following two points</p> <p>M1 greater demand for short chain alkanes (than long chain alkanes)</p> <p>M2 more long-chain alkanes than are needed / too great a supply of /surplus of long-chain alkanes</p> <p>OR not enough short chain alkanes to meet demands</p>	<p>ALLOW short chain alkanes are more useful (than long chain alkanes)</p> <p>ALLOW short chain alkanes needed for specific uses e.g. petrol</p>	2
(f)	<p>$(\text{C}_{11}\text{H}_{24} \rightarrow \text{C}_5\text{H}_{12}) + \text{C}_2\text{H}_4 + \text{C}_4\text{H}_8$</p> <p>M1 C_2H_4</p> <p>M2 C_4H_8</p>	<p>alkenes can be in either order</p> <p>ALLOW 1 mark for C_6H_{12} / $2\text{C}_3\text{H}_6$ / $\text{C}_3\text{H}_6 + \text{C}_3\text{H}_6$</p> <p>ALLOW correct displayed formulae</p>	2
			Total 11

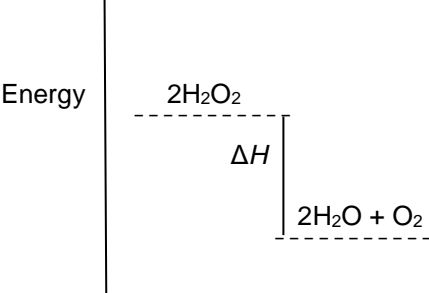
Question number	Answer	Notes	Marks
3 (a)	<p>An explanation that links the following two points</p> <p>M1 electrons are delocalised</p> <p>M2 (electrons) can move/can flow/are mobile</p>	<p>IGNORE sea of electrons /free electrons</p> <p>REJECT cations/atoms move for both marks</p> <p>M2 dep on M1 or mention of electrons i.e. 'electrons move' scores 1 mark</p>	2
(b) (i)	<p>M1 brown/pink/pink-brown solid formed</p> <p>M2 bubbles/fizzing/effervescence</p>	<p>ACCEPT brown/pink coating/deposit on the electrode</p> <p>ALLOW red-brown</p> <p>REJECT orange</p> <p>REJECT precipitate</p> <p>ALLOW 1 mark if both observations correct but at incorrect electrodes</p> <p>IGNORE gas produced /evolved/released</p> <p>IGNORE name of gas</p>	2
(ii)	copper ion(s)/Cu ²⁺ gains electrons	<p>ACCEPT oxidation state of copper goes down / goes from +2 to 0</p> <p>IGNORE references to loss of oxygen</p> <p>ALLOW electrons are gained</p> <p>REJECT copper/Cu gains electrons</p>	1
(iii)	<p>An explanation that links the following two points</p> <p>M1 the (blue) colour is caused by copper ions/Cu²⁺</p> <p>M2 copper ions/Cu²⁺ are being discharged/ removed from the solution</p>	<p>ACCEPT concentration of copper ions/Cu²⁺ decreases</p> <p>ALLOW copper ions/Cu²⁺ form copper</p>	2

Question number	Answer	Notes	Marks
3 (c)	<ul style="list-style-type: none">• 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 <p>Example calculation</p> <p>M1 $(12.5 - 8.0) = 4.5$ (g)</p> <p>M2 $n(\text{CuSO}_4) = 8.0 \div 159.5 = 0.05(0)$ (mol)</p> <p>M3 $n(\text{H}_2\text{O}) = 4.5 \div 18 = 0.25$ (mol)</p> <p>M4 $0.25 \div 0.05(0) (= 5)$</p>	ACCEPT alternative methods which show that the answer is 5	4
			Total 11

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

Question number	Answer	Notes	Marks
4 (c)	<ul style="list-style-type: none"> • calculate the amount, in moles, of sodium hydroxide • calculate the amount, in moles, of sulfuric acid • calculate the concentration of sulfuric acid <p>Example calculation</p> <p>M1 $n(\text{NaOH}) = 0.0250 \times 0.200$ or 0.005 (mol)</p> <p>M2 $n(\text{H}_2\text{SO}_4) = 0.005 \div 2$ or 0.0025 (mol)</p> <p>M3 $\text{conc}^n = (0.0025 \div 0.0167) = 0.150$ (mol/dm³)</p>	<p>answer to M1 $\div 2$</p> <p>answer to M2 $\div 0.0167$</p> <p>ALLOW 0.1497 or any number of sig fig except one</p> <p>Correct answer without working scores 3</p> <p>ACCEPT alternative methods</p>	<p>3</p> <p>Total 9</p>

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)	<ul style="list-style-type: none"> • find energy needed to break bonds • find energy released when bonds form • correct subtraction to find ΔH <p>Example calculation</p> <p>M1 $(4 \times 463) + (2 \times 143)$ OR 2138 (kJ)</p> <p>M2 $(4 \times 463) + 498$ OR 2350 (kJ)</p> <p>M3 -212 (kJ) OR M1 – M2 correctly evaluated</p>	<p>ACCEPT $(2 \times 143)/286$ for M1 and 498 for M2</p> <p>IGNORE any signs in M1 and M2</p> <p>– 212 with or without working scores 3</p> <p>(+) 212 with or without working scores 2</p>	3
(ii)	 <p>M1 horizontal line to show products in correct position and correctly labelled</p> <p>M2 vertical line in correct position and labelled ΔH</p>	<p>Mark CQ on sign in (i)</p> <p>ACCEPT double headed arrow or arrow pointing from reactants level to products level</p> <p>REJECT arrow pointing from products level to reactants level</p> <p>IGNORE any attempts at including activation energy</p>	2
Total 8			

Question number	Answer	Notes	Marks
6 (a) (i)	<p>M1 300 (°C)</p> <p>M2 60 to 70 (atm)</p>	<p>ACCEPT any temperature or range 250 to 350 inclusive.</p> <p>ACCEPT any correct alternative unit and quantity</p> <p>ACCEPT any pressure or range 60 to 70 inclusive</p> <p>ACCEPT any correct alternative unit and quantity</p>	2
(ii)	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $	<p>All bonds including bond between O and H must be shown.</p>	1
(b) (i)	$\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO}_2 + 3\text{H}_2\text{O}$ <p>M1 all formulae correct</p> <p>M2 balancing of correct formulae</p>	<p>ALLOW C₂H₆O for ethanol</p> <p>ACCEPT multiples and fractions</p> <p>IGNORE state symbols even if incorrect</p> <p>M2 dep on M1</p>	2
(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)	$\begin{array}{c} \text{O} & & \text{O} \\ \parallel & & \parallel \\ -\text{C}-\text{CH}_2\text{CH}_2-\text{C}-\text{O}-\text{CH}_2\text{CH}_2-\text{O}- \end{array} + 2\text{H}_2\text{O}$ <p>M1 correct ester link</p> <p>M2 rest of polymer structure correct with extension bonds</p> <p>M3 2H₂O</p>	<p>ACCEPT</p> $\begin{array}{c} \text{O} & & \text{O} \\ \parallel & & \parallel \\ -\text{O}-\text{C}-\text{CH}_2\text{CH}_2-\text{C}-\text{O}-\text{CH}_2\text{CH}_2- \end{array}$ <p>for M1 and M2</p> <p>If brackets and n present equation must be fully balanced with n in front of each reactant and 2nH₂O for full marks, otherwise max 2</p> <p>If dimer is drawn with OH at one end and COOH at the other a mark can be awarded for H₂O without the 2 as this equation is then balanced, so M1 and M3 can be awarded.</p>	3
			Total 11

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

(ii)	$\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$ 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
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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)	<ul style="list-style-type: none"> 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 $n(\text{magnesium nitrate}) = 7.7 \div 148$ or 0.052 (mol) M2 $n(\text{gas}) = 5 \times 0.052 \div 2$ or 0.13 (mol) M3 Total volume of gas = 0.13×24 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			

