



Mark Scheme (Results)

Summer 2021

Pearson Edexcel International GCSE
In Chemistry (4CH1) Paper 2C

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2021

Question Paper Log Number 66057

Publications Code 4CH1_2C_2106_MS

All the material in this publication is copyright

© Pearson Education Ltd 2021

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)	(i) silicon	ALLOW Si	1
	(ii) boron	ALLOW B	1
	(iii) magnesium	ALLOW Mg	1
(b)	(i) 16 / sixteen		1
	(ii) 2.8.3 / 2,8,3	ACCEPT diagram showing correct electron configuration ALLOW correct electron configuration using s and p notation	1
	(iii) does not (easily) gain/lose/share electrons	ALLOW full outer shell/energy level ALLOW 8 electrons in outer shell/energy level	1
			Total 6

Question number	Answer	Notes	Marks
2 (a) (i)	red-brown (coating on nail)	<p>ACCEPT orange-brown / brown</p> <p>ALLOW orange</p> <p>IGNORE rust colour</p> <p>IGNORE red alone</p>	1
(ii)	(hydrated) iron(III) oxide/ferric oxide	<p>ACCEPT (hydrated) iron oxide</p> <p>REJECT iron oxide with incorrect oxidation state</p>	1
(b)	<p>An explanation that links 4 of the following 5 points</p> <p>tube 1</p> <p>M1 air/oxygen is needed for rusting</p> <p>M2 boiled water does not contain air/oxygen</p> <p>M3 oil keeps air/oxygen out</p> <p>tube 2</p> <p>M4 water/moisture is needed for rusting</p> <p>M5 drying agent keeps water/moisture out</p>	<p>ALLOW 1 mark for no air/oxygen present as an alternative to M1 and M2</p> <p>ALLOW 1 mark for no water/moisture present as an alternative to M4 and M5</p>	4
			Total 6

Question number	Answer	Notes	Marks
3 (a)	(i) fractionating column/ fractionating tower	ALLOW fraction(al) column /fraction(al) tower IGNORE fractional distillation	1
	(ii) fuel for ships/fuel for power stations		1
	(iii) M1 fraction A refinery gases M2 fraction F bitumen		2
(b)	(i) C_nH_{2n+2}	ALLOW x or N in place of n	1
	(ii) An explanation that links the following 3 points M1 $C_{12}H_{26}$ has larger molecules/longer chain/ORA M2 $C_{12}H_{26}$ has stronger intermolecular forces/ORA M3 more energy is needed to separate the molecules/ overcome the forces in $C_{12}H_{26}$ /ORA	ACCEPT forces between molecules for intermolecular forces ALLOW intermolecular bonds /bonds between molecules no M2 or M3 if implied that covalent bonds break	3
	(c) (i) silica/alumina	ACCEPT silicon dioxide /aluminium oxide / SiO_2/Al_2O_3 /aluminosilicates /zeolite	1
	(ii) $C_{12}H_{26} \rightarrow C_9H_{20} + C_3H_6$		1
			Total 10

Question number	Answer	Notes	Marks
4 (a)	(i) all points plotted correctly to the nearest grid line		1
	(ii) point at 50 °C and 17.5 g circled on grid/in table	ALLOW ECF from incorrect plotting	1
	(iii) smooth curve of best fit		1
(b)	Any two from M1 less than 25 cm ³ of water was used M2 the temperature was less than 50 °C M3 not enough potassium nitrate was added M4 the solution was not stirred	ALLOW ECF from incorrect plotting and incorrect point circled for M1 and M2 only	2

Question number	Answer	Notes	Marks
4 (c)	M1 curve extended to 75 °C M2 correct mass read from graph to the nearest grid line	expected answer around 39 to 40 g 0 marks if curve not extended	2
(d)	M1 mass at 25 °C read from graph to nearest grid line M2 mass from graph multiplied by 4	expected answer around 44 g ALLOW ECF from incorrect plotting	2
			Total 9

Question number	Answer	Notes	Marks
5 (a)	Any two from: M1 same general formula M2 each member differs from the next by CH ₂ M3 same functional group M4 similar chemical properties/reactions M5 trend/steady increase in physical properties	ALLOW same chemical properties/reactions ACCEPT named physical properties e.g. trend in boiling points	2
(b) (i)	H ₂ SO ₄	If name and formula given, name must be correct.	1
(ii)	M1 from orange M2 to green	colours must be in the correct order	2
(iii)	M1 $\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$ M2 $\begin{array}{c} \text{H} \quad \text{O} \\ \quad // \\ \text{H}-\text{C}-\text{C} \\ \quad \backslash \\ \text{H} \quad \text{O}-\text{H} \end{array}$	Penalise no bond between O and H once only	2

Question number	Answer	Notes	Marks
5 (c) (i)	<p>A discussion which refers to any six of the following points:</p> <p>Advantages of fermentation/disadvantages of hydration</p> <p>M1 sugar cane can be re-grown/is renewable</p> <p>M2 crude oil is finite/cannot be replaced/is non-renewable</p> <p>M3 fermentation uses lower temperatures so energy costs are lower/ hydration uses higher temperatures, so energy costs are higher</p> <p>M4 fermentation uses lower pressure so energy costs are lower/ hydration uses higher pressure, so energy costs are higher</p> <p>M5 yeast is a natural substance and not harmful/ phosphoric acid is corrosive</p> <p>Advantages of hydration/disadvantages of fermentation</p> <p>M6 hydration is a faster process/ fermentation is a slower process</p> <p>M7 hydration gives pure ethanol/ fermentation gives impure ethanol</p> <p>M8 growing sugar cane takes up land which could be used for growing food/rearing livestock</p> <p>M9 hydration is a continuous process/fermentation is a batch process</p>		6
(ii)	$\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2$	<p>ALLOW 2C₂H₆O for ethanol</p> <p>ALLOW multiples and fractions</p>	1
			Total 14

Question number	Answer	Notes	Marks
6 (a)	(i) (squeaky) pop with lighted splint		1
	(ii) M1 (damp) litmus paper/ universal indicator M2 bleached	ACCEPT turns white OR decolourised ACCEPT (damp) blue litmus turns red and is bleached scores M1 and M2	2
(b)	(i) chloride ions/Cl ⁻ lose electrons /electrons are lost	ALLOW oxidation state of chlorine increases /changes from -1 to 0 REJECT chlorine loses electrons REJECT reference to gain of oxygen	1
	(ii) $2\text{H}^+ + 2\text{e}^{-} \rightarrow \text{H}_2$		1
	(iii) chlorine is toxic/poisonous		1
	(iv) (some) chlorine dissolves (in the solution)	ALLOW chlorine dissolves in water	1

Question number	Answer	Notes	Marks
6 (c) (i)	<p>An explanation that links two of the following points</p> <p>M1 in solid sodium chloride the ions are not free to move/are in fixed positions</p> <p>M2 in molten sodium chloride the ions are mobile</p> <p>M3 ions/charged particles need to move for current (to flow) / to conduct electricity</p>	<p>No marks if reference to mobile electrons</p>	2
	<p>(ii)</p> <ul style="list-style-type: none"> • calculate the amount, in moles, of NaCl • determine the amount, in moles, of Cl₂ • calculate the volume of Cl₂ • give the final answer in standard form <p>Example calculation</p> <p>M1 $\frac{23\,400\,000}{58.5}$ OR 400 000</p> <p>M2 $\frac{400\,000}{2}$ OR 200 000</p> <p>M3 200 000 x 24 OR 4 800 000 (dm³)</p> <p>M4 4.8 x 10⁶ (dm³)</p>	<p>OR $\frac{\text{answer to M1}}{2}$</p> <p>OR answer to M2 x 24</p> <p>OR answer to M3 in standard form</p> <p>correct answer in standard form without working scores 4</p> <p>4 800 000 without working scores 3</p> <p>9.6 x 10⁶ and 1.92 x 10⁷ score 3</p> <p>9 600 000 and 19 200 000 score 2</p> <p>M4 can be awarded for an answer in standard form as long as some working is shown</p>	4
			Total 13

Question number	Answer	Notes	Marks
7 (a)	<p>M1 X conical flask</p> <p>M2 Y pipette</p> <p>M3 Z burette</p>		3
(b)	<p>B colourless</p> <p>A is not correct as the colour of phenolphthalein in phosphoric acid is not blue</p> <p>C is not correct as phenolphthalein is pink in alkali not in acid</p> <p>D is not correct as the colour of phenolphthalein in phosphoric acid is not red</p>		1

Question number	Answer	Notes	Marks
7 (c) (i)	ticks in boxes 1, 2 and 4		1
(ii)	M1 $\frac{30.35 + 30.25 + 30.30}{3}$ M2 30.30	30.30 without working scores 2 30.3 without working scores 1 If no results ticked then only use of 2 or 3 concordant titres can score both marks in (ii) If only one result ticked then M2 can be scored for averaging two or more titre values correctly M1 CQ on results ticked M2 CQ on correct calculation from M1 Answer to M2 must be correct to 2dp	
(d) (i)	M1 $\frac{30.40 \times 0.525}{1000}$ M2 0.01596 (mol)	If no division by 1000 giving an answer of 15.96 award 1 mark correct answer without working scores 2	2
(ii)	$(0.01596 \div 3) = 0.00532$ (mol)	OR answer to (i) $\div 3$	1
(iii)	M1 $\frac{0.00532 \times 1000}{25.0}$ M2 0.2128 (mol/dm ³)	OR $\frac{\text{answer to (ii)} \times 1000}{25.0}$ OR answer to M1 evaluated correctly correct answer without working scores 2 ACCEPT answers to any number of sig figs except 1 throughout (d) If no division by 1000 in (i) and no multiplication by 1000 in (iii) do not penalise twice	2
			Total 12

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom