



Mark Scheme (Results)

November 2023

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

November 2023

Question Paper Log Number P73425A

Publications Code 4CH1_2C_MS_2311

All the material in this publication is copyright

© Pearson Education Ltd 2023

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 (9) A is incorrect as there are not 7 electrons in total C is incorrect as there are not 10 electrons in total D is incorrect as there are not 19 electrons in total		1
(b)	A (1-) B is incorrect as the charge on a bromide ion is not 1+ C is incorrect as the charge on a bromide ion is not 2- D is incorrect as the charge on a bromide ion is not 2+		1
(c)	C (grey solid) A is not correct as iodine is not a brown liquid at room temperature B is not correct as iodine is not a brown solid at room temperature D is not correct as iodine is not a purple gas at room temperature		1
(d)	An explanation that links the following three points M1 chlorine displaces bromine and iodine/chlorine reacts with bromide and iodide (ions) M2 bromine displaces iodine/iodine doesn't displace chlorine or bromine /bromine reacts with iodide (ions) /iodine doesn't react with chloride or bromide (ions) M3 most reactive chlorine least reactive bromine iodine	ALLOW chlorine has two reactions ALLOW iodine has no reactions ACCEPT chlorine is most reactive and iodine is least reactive ALLOW reactivity decreases down the group Deduct 1 mark only for incorrect use of ide or ine	3
			Total 6

Question number	Answer	Notes	Marks
2 (a) (i)	white solid/powder/ash	ALLOW (pale/light) grey solid/powder /ash REJECT white precipitate IGNORE bright/white flame	1
(ii)	$2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$	ALLOW multiples and fractions IGNORE state symbols even if incorrect	1
(iii)	An explanation that links the following two points M1 (oxygen is used in the reaction so) volume/amount of air/oxygen decreases /pressure decreases M2 (water level rises) to take the place of the oxygen /to equalise the pressure OWTTE	ALLOW arguments in terms of pressure	2
(b)	M1 percentage of oxygen in air = 21% /percentage of air remaining = 79% M2 volume of air remaining = $\frac{2000 \times 79}{100}$ (cm ³) M3 1580 (cm ³)	ALLOW 20% / 80% M2 subsumes M1 ALLOW ecf if incorrect percentage used use of 80% gives an answer of 1600 (cm ³) correct answer of 1580 or 1600 without working scores 3 420 /400 scores 2	3
(c)	The percentages of argon and carbon dioxide are very small OWTTE	ACCEPT references to approximate percentages ALLOW (all the oxygen has been removed and) only 1% / small amounts of the other gases remain	1
			Total 8

Question number	Answer	Notes	Marks
3 (a)	aluminium/it is more reactive than carbon/aluminium/it is above carbon in the reactivity series ORA		1
(b)	<p>An explanation which links two pairs of points</p> <p>Pair 1 M1 drink cans</p> <p>M2 malleable/low density</p> <p>Pair 2 M1 aircraft/aeroplanes/bicycle frames/car bodies</p> <p>M2 low density</p> <p>Pair 3 M1 (overhead) power cables</p> <p>M2 (good) conductor of electricity /low density /malleable /ductile</p> <p>Pair 4 M1 pans</p> <p>M2 (good) conductor of heat</p> <p>Pair 5 M1 (aluminium) foil</p> <p>M2 malleable</p>	<p>In all cases M2 is dep on M1</p> <p>ALLOW does not corrode/ non-toxic /doesn't react with the drink</p> <p>ALLOW does not corrode</p> <p>ALLOW wires</p> <p>ALLOW does not corrode/ non-toxic / doesn't react with the food</p> <p>ALLOW does not corrode/ non-toxic / doesn't react with the food /prevents heat loss</p> <p>ACCEPT any correct use with corresponding relevant property</p> <p>REJECT any incorrect answer for M2</p>	4

(c)	<p>An explanation that links the following three points</p> <p>M1 in pure metal layers (of atoms/cations /particles) slide over each other (easily) OWTTE</p> <p>M2 in an alloy the different sized/larger atoms /cations/particles disrupt the structure/are more randomly arranged</p> <p>M3 which prevents layers (of atoms/cations /particles) sliding over each other</p>	<p>ALLOW sheets/rows for layers</p> <p>REJECT molecules /intermolecular forces /negative ions /anions /ionic /covalent for 1 mark only</p> <p>Deduct 1 mark if no mention of layers/sheets/rows</p>	3
			Total 8

Question number	Answer	Notes	Marks
4 (a)	Any two from M1 concentration of sodium hydroxide (solution) M2 rate of / same stirring M3 temperature of sodium hydroxide (solution)	IGNORE references to concentration of acid IGNORE references to volume / mass / amount of either solution ALLOW temperature of the room / environment	2
(b)	An explanation that links any two of the following points M1 polystyrene/it is a better insulator than glass OWTTE M2 less heat/thermal energy will be lost M3 using a polystyrene cup will lead to a more accurate/a higher <u>temperature</u> (change)	ALLOW polystyrene/it is an insulator ALLOW prevents heat loss /retains heat	2
(c) (i)	any value between 32.0 and 33.0 inclusive		1
(c) (ii)	An explanation that links the following three points M1 the first line shows that as more sodium hydroxide is added the temperature rises (at a steady rate) M2 the point where the lines cross/ the highest temperature reached/ the volume of 21-22 cm ³ of sodium hydroxide shows that the sodium hydroxide has neutralised the acid/ the acid has fully reacted M3 the second line shows that (there is no further reaction and) the cool sodium hydroxide solution decreases the temperature OWTTE	ACCEPT the temperature is directly proportional to the volume added ALLOW there is a positive correlation between the temperature and the volume added ALLOW the second line shows that there is no further reaction as the mixture cools down OWTTE	3

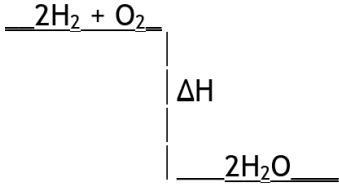
(d)	<p>M1 mass of solution = 25 + 22 OR 47 (g)</p> <p>M2 $Q = mc\Delta T$ OR $Q = 47 \times 4.2 \times 35$</p> <p>M3 6909 (J)</p> <p>M4 6.9 (kJ)</p>	<p>correct answer without working scores 4</p> <p>ALLOW ecf from M1 if incorrect mass used e.g. use of 1, 22 or 25</p> <p>M2 subsumes M1</p> <p>ALLOW ecf from M3 if correct conversion from J to kJ</p> <p>147 / 3234 / 3675 (J) score 2</p> <p>0.147 / 3.234 / 3.675 (kJ) score 3</p> <p>ACCEPT any number of significant figures correctly rounded except 1</p>	4
			Total 12

Question number	Answer	Notes	Marks
5 (a) (i)	$2\text{CH}_3\text{COOH} + \text{Mg} \rightarrow (\text{CH}_3\text{COO})_2\text{Mg} + \text{H}_2$ M1 $2\text{CH}_3\text{COOH} + \text{Mg}$ M2 H_2	ALLOW multiples and fractions ALLOW $2\text{C}_2\text{H}_4\text{O}_2$ REJECT $2\text{CH}_4\text{COO}$ IGNORE state symbols even if incorrect	2
(ii)	M1 effervescence/fizzing/bubbles M2 magnesium becomes smaller/disappears	IGNORE gas evolved ALLOW dissolves	2
(b) (i)	(concentrated) sulfuric acid	ALLOW any suitable inorganic acid e.g. hydrochloric or nitric or phosphoric IGNORE dilute	1
(ii)	C ($\text{CH}_3\text{CH}_2\text{COOCH}_3$) A is incorrect as it is propyl methanoate B is incorrect as it is propyl ethanoate D is incorrect as it is methyl butanoate		1
(c) (i)	condensation (polymerisation)		1
(ii)	water	ALLOW H_2O	1
(iii)	$\begin{array}{cccc} \text{O} & \text{O} & \text{H} & \text{H} \\ & & & \\ -\text{C} & -\text{C} & -\text{O} & -\text{C} & -\text{C} & -\text{O}- \\ & & & & & \\ & & \text{H} & \text{H} & & \end{array}$ M1 correct displayed ester functional group M2 rest of structure correct	ALLOW structure without extension bonds O can be on LHS instead of on RHS IGNORE brackets and n	2
(d)	(a polyester that) is biodegradable	ACCEPT can be degraded by bacteria ALLOW can be decomposed	1
			Total 11

Question number	Answer	Notes	Marks
6 (a)	M1 (X) pipette M2 (Y) burette		2
(b)	methyl orange/phenolphthalein/litmus (solution)	REJECT universal indicator REJECT litmus paper IGNORE pp indicator ACCEPT other alternative appropriate indicators	1
(c) (i)	M1 (moles of $\text{Na}_2\text{CO}_3 = \frac{0.220 \times 25.0}{1000}$ OR 0.0055(0) M2 (moles of $\text{HNO}_3 = 0.0055(0) \times 2$ OR 0.011(0) M3 (volume of $\text{HNO}_3 = \frac{0.011(0) \times 1000}{0.350} = 31.4$ (cm ³)	Correct answer without working scores 3 If they use mega moles can still score 3 for 31.4 ALLOW ecf from M1 ALLOW ecf on incorrect moles in M2 ACCEPT any number of sig figs except 1 ACCEPT alternative methods 7.86 /7.9 /7.857 scores 2 15.7 /16 scores 2	3
(ii)	M1 (moles of $\text{Na}_2\text{CO}_3 = \frac{0.220 \times 25.0}{1000} = 0.0055(0)$ so moles of $\text{CO}_2 = 0.0055(0)$ M2 (volume of $\text{CO}_2 = 0.0055(0) \times 24\,000 = 132$ (cm ³)	Correct answer without working scores 2 ALLOW ecf on incorrect number of moles from (i) If they use mega moles in (i) only 1 mark for 132000	2

(d)	<p>A description that refers to the following three points</p> <p>M1 add (dilute) hydrochloric acid (to the sodium carbonate)</p> <p>M2 bubble/pass the gas through limewater OR test the gas with limewater</p> <p>M3 (limewater) turns milky/cloudy</p>	<p>ALLOW any suitable named acid</p> <p>REJECT any other incorrect reagent for M1 and M2</p> <p>M2 dep on M1 or mention of adding acid</p> <p>ALLOW white precipitate</p> <p>M3 dep on limewater</p>	3
			Total 11

Question number	Answer	Notes	Marks
7 (a)	An explanation that links the two points M1 in solid sodium chloride ions are in a fixed position/in a lattice/cannot move M2 when molten or in solution ions are free to move/flow	No marks if reference to electrons moving	2
(b) (i)	$2\text{H}_2\text{O} \rightarrow 4\text{H}^+ + (1)\text{O}_2 + 4\text{e}^-$	ALLOW multiples and fractions IGNORE state symbols even if incorrect	1
(ii)	chloride (ions)/(2)Cl ⁻ /it lose electrons	ALLOW electrons are lost REJECT chlorine loses electrons	1
(c) (i)	(squeaky) pop with lighted splint	REJECT glowing splint	1
(ii)	An explanation that links any three of the following four points M1 solution/water contains hydrogen ions/H ⁺ M2 hydrogen ions/H ⁺ are attracted to the negative electrode/cathode M3 hydrogen ions/H ⁺ gain electrons M4 and (combine in pairs to) form hydrogen molecules/H ₂	IGNORE sodium ions Can score M3 and M4 for fully correct half equation. i.e. $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	3
(d) (i)	M1 Σ bond energies on LHS = $2 \times 436 + 498$ OR 1370 (kJ) M2 Σ bond energies on RHS = 4×463 OR 1852 (kJ) M3 $(1370 - 1852) = -482$ (kJ)	Correct answer without working scores 3 ALLOW ecf on M1 and M2 ALLOW -241 (kJ) (for 1 mole of water) for all 3 marks sign required to score M3	3

Question number	Answer	Notes	Marks
7 (d) (ii)	<p>M1 two horizontal lines in correct positions with products line to the right of reactants line</p> <p>M2 horizontal lines labelled correctly with formulae of reactants and products</p> <p>M3 vertical line in correct position and labelled ΔH</p> 	<p>ALLOW ecf on incorrect positive value for M3</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 activation energy hump</p>	3
			Total 14

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