



Mark Scheme (Results)

Summer 2023

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

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 2023

Question Paper Log Number P71953A

Publications Code 4CH1_2CR_2306_MS

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)	<table><tr><th>Subatomic particle</th><th>Relative mass</th><th>Relative charge</th></tr><tr><td>proton</td><td>1</td><td>+1</td></tr><tr><td>neutron</td><td>1</td><td>0</td></tr><tr><td>electron</td><td>0.0005</td><td>-1</td></tr></table>	Subatomic particle	Relative mass	Relative charge	proton	1	+1	neutron	1	0	electron	0.0005	-1	All 4 correct = (2) 2 or 3 correct = (1) 0 or 1 correct = (0)	2
Subatomic particle	Relative mass	Relative charge													
proton	1	+1													
neutron	1	0													
electron	0.0005	-1													
(b) (i)	A increasing atomic number B is incorrect as elements are not arranged in order of increasing melting point C is incorrect as elements are not arranged in order of increasing reactivity D is incorrect as elements are not arranged in order of increasing relative atomic mass		1												
(ii)	D Group 5 Period 3 A is incorrect as phosphorus is not in Group 2 and Period 5 B is incorrect as phosphorus is not in Group 3 and Period 5 C is incorrect as phosphorus is not in Group 5 and Period 2		1												
(iii)	M1 Xe / xenon M2 because it has a full outer shell (of electrons) / 8 electrons in the outer shell	M2 dep on M1 IGNORE refs to noble gas	2												
			Total 6												

Question number	Answer	Notes	Marks
2 (a)			2
	Physical state at room temperature	Colour	
	gas	pale green / yellow	
	gas	green	
	liquid	red-brown	
	solid	grey	
(b)	M1 bromine <u>water</u> / bromine <u>solution</u> M2 turns colourless / decolourised	ALLOW <u>aqueous</u> bromine IGNORE any starting colour M2 is dep on mention of bromine in M1	2
(c)	M1 (mixture) turns (from colourless) to brown M2 iodine / I ₂ is displaced OR (chlorine reacts with iodide ions) to produce / form iodine M3 (because) chlorine is more reactive (than iodine)	ALLOW red-brown / orange-brown REJECT iodide IGNORE a displacement reaction occurs M2 can be scored by I ₂ as a product in a balanced equation or by a word equation ALLOW reverse argument REJECT iodide, except if already penalised in M2	3
			Total 7

Question number	Answer	Notes	Marks
3 (a) (i)	magnesium		1
(ii)	M1 gold M2 is the least reactive	IGNORE silver M2 DEP on M1 ALLOW it is (the most) unreactive	2
(b) (i)	(an alloy is) a mixture of metals OR (an alloy is) a mixture of a metal and another metal	ALLOW (an alloy is) a mixture of a metal and carbon REJECT references to compounds / combining of metals	1
(ii)	M1 the regular arrangement of atoms is distorted / disrupted / disturbed OWTTE OR carbon atoms are smaller than iron atoms / because iron atoms are larger than carbon atoms M2 (therefore) it is more difficult for the atoms/layers to slide over one another	ALLOW lattice / layers / rows of atoms are disrupted / distorted / are less regular / are irregular ALLOW carbon and iron atoms are of different sizes ALLOW the atoms are not the same size / the atoms are different sizes IGNORE references to the strength of metallic bonds	2
			Total 6

Question number	Answer	Notes	Marks
4 (a)	(i) refinery gases: (fuel for) heating / cooking bitumen: tar / road surfacing / road building / roofing	ALLOW bottled gas ALLOW roads	2
	(ii) any one from: refinery gases have the low(est) boiling point OR refinery gases do not condense in the column	ALLOW they are the most volatile REJECT refs to melting point	1
	(iii) it is heated / vaporised	IGNORE any temperatures given ALLOW boiled	1
(b)	(i) M1 temperature 600 – 700°C M2 catalyst alumina / silica / zeolites / aluminium oxide / silicon dioxide	ALLOW any temperature in the range IGNORE pressures	2
	(ii) an explanation containing any three of the following points: M1 alkenes / propene / C ₃ H ₆ can be used to make (addition) polymers / plastics M2 (because) they have double bonds / are unsaturated M3 shorter alkanes / octane / C ₈ H ₁₈ are used as fuels / petrol M4 (because) they have lower boiling points / are more flammable	ALLOW used to make poly(propene) ALLOW to make alcohols / propanol IGNORE used as fuels	3
			Total 9

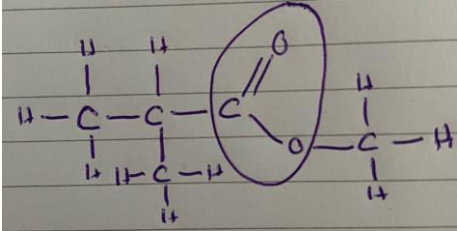
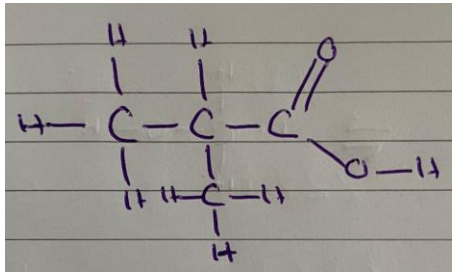
Question number	Answer	Notes	Marks
5 (a)	<p>M1 mix / react the two solutions (together)</p> <p>M2 filter (the solid lead bromide)</p> <p>M3 wash (using deionised water)</p> <p>M4 method of drying</p>	<p>IGNORE volumes</p> <p>IGNORE heating at this stage</p> <p>REJECT an indication that solids are mixed for M1</p> <p>IGNORE any washing before filtering</p> <p>eg leave to dry / dry in an oven / leave in a warm place / dry with filter paper</p> <p>REJECT direct heating of final product for M4</p> <p>REJECT if solid is washed again after drying for M4</p> <p>Methods of producing a soluble salt eg evaporating after mixing, leaving solutions in an evaporating basin scores M1 only</p>	4
(b)	<p>M1 0.150×367 OR 55.05 g</p> <p>M2 $(49.6 \div 55.05) \times 100$</p> <p>OR</p> <p>M1 $(49.6 \div 367)$ OR 0.1351</p> <p>M2 $(0.1351 \div 0.150) \times 100$</p>	<p>ALLOW 0.135</p> <p>ALLOW a final answer of 90% by either method</p> <p>REJECT $(49.6 \div 0.15) = 330.67$ $(330.67 \div 367) \times 100$ for both marks</p>	2
(c) (i)	all 6 points plotted $\pm$ half a square		1
(ii)	<u>straight</u> line of best fit ignoring the anomalous result at volume = 20 cm ³		1

	(iii)	<p>M1 the conductivity decreases (when the volume of lead(II) nitrate added increases)</p> <p>M2 there are fewer ions in the mixture</p>	<p>IGNORE proportional /inversely proportional</p> <p>REJECT directly proportional</p> <p>ACCEPT negative correlation between volume of lead(II) nitrate and electrical conductivity</p> <p>ALLOW the conductivity increases when the volume of lead(II) nitrate decrease</p> <p>ALLOW ions are being removed (as lead(II) bromide is formed)</p>	2
	(iv)	the student forgot to stir the mixture	<p>ALLOW the student didn't allow enough time for the reaction to take place before measuring conductivity</p> <p>REJECT the student added less / too little lead(II) nitrate solution</p>	1
	(v)	the conductivity would increase		1
(d)		electrons are lost (from bromide ions)	REJECT bromine / bromine ions lose electrons	1
				Total 13

Question number	Answer	Notes	Marks
6 (a)	<p>M1 (electrostatic attraction between) <u>positive</u> ions</p> <p>M2 (and) <u>delocalised</u> electrons</p>	<p>ACCEPT (electrostatic attraction between positive) nuclei of (metal) atoms</p> <p>REJECT any references to ionic bonding / sharing of electrons / intermolecular forces for both marks</p>	2
(b) (i)	(squeaky) pop with lighted splint/lit with a (Bunsen) flame	<p>IGNORE just 'burns with a squeaky pop'</p> <p>REJECT use of glowing splint</p>	1
(ii)	<p>any two from:</p> <p>M1 lilac / purple flame</p> <p>M2 potassium melts / turns into a ball</p> <p>M3 potassium moves on the surface</p> <p>M4 potassium gets smaller</p>	<p>ALLOW flame</p> <p>REJECT other colours</p> <p>ALLOW floats</p> <p>ALLOW potassium disappears / dissolves</p> <p>IGNORE fizzing / bubbles etc</p>	2
(c)	<p>an explanation linking the following points:</p> <p>M1 lithium has fewer shells than potassium</p> <p>M2 <u>outer</u> shell / <u>outer</u> electron in lithium is more strongly attracted to the nucleus</p> <p>M3 (so in lithium the outer shell) <u>electron</u> is less easily lost</p>	<p>ALLOW lithium has smaller atoms than potassium</p> <p>ALLOW (outer shell) electron in lithium is closer to the nucleus</p> <p>ALLOW correct electron configurations</p> <p>REJECT 'fewer outer shells'</p> <p>ALLOW <u>outer</u> shell / <u>outer</u> electron in lithium is less shielded (by inner shells)</p> <p>ACCEPT valence electron</p> <p>ALLOW reverse argument throughout for potassium</p>	3

(d)	<p>M1 (moles of sodium) $0.75 \div 23$ OR 0.0326 moles</p> <p>M2 (moles of hydrogen) $0.0326 \div 2$</p> <p>M3 (volume of hydrogen) 391.304 (cm³)</p> <p>M4 391 (cm³)</p>	<p>ALLOW M1 $\div 2$</p> <p>ALLOW M2 $\times 24\,000$</p> <p>REJECT incorrect rounding / use of 1SF once in M1 - M3</p> <p>ALLOW M3 to 3 significant figures, provided some attempt at calculation</p> <p>391 (cm³) scores 4 marks</p> <p>If M1 is rounded to 0.033 moles, final answer of 396 (cm³) scores 4 marks</p> <p>If M2 is absent, final answer of 782 / 783 (cm³) scores 3 marks</p> <p>If $\times 2$ instead of $\div 2$ in M2 , final answer of 1560 (cm³) scores 3 marks</p>	4
(e)	<p>M1 (moles of sulfuric acid) $(16.3 \times 0.0500) \div 1000$ OR 0.000815</p> <p>M2 (moles of sodium hydroxide) = 0.00163</p> <p>M3 0.0652 (mol/dm³)</p>	<p>ALLOW 8.15×10^{-4} (moles)</p> <p>ALLOW M1 $\times 2$</p> <p>ALLOW M2 $\div 0.025$</p> <p>0.0652 (mol/dm³) scores 3 marks</p> <p>ALLOW any SF except 1SF</p> <p>If M2 is absent, final answer of 0.0326 (mol/dm³) scores 2 marks</p> <p>If $\div 2$ instead of $\times 2$ in M2 , final answer of 0.0163 (mol/dm³) scores 2 marks</p> <p>REJECT $16.3 / 25.0 = 0.652$ (mol/dm³) for all 3 marks</p>	3
			Total 15

Question number	Answer	Notes	Marks
7 (a) (i)	<p>M1 the forward and reverse reactions occur at the same <u>rate</u></p> <p>M2 so the concentrations of reactants and products remain constant</p>	<p>ALLOW so the moles of reactants and products remain constant</p> <p>REJECT so the concentrations of reactants and products are the same</p>	2
(ii)	a catalyst increases the rate of (both) the forwards and the reverse reaction <u>equally</u>	ALLOW has the same effect on the rate of forward and reverse reaction	1
(iii)	<p>M1 yield increases</p> <p>M2 the (forward) reaction is exothermic</p>	<p>ALLOW the reverse reaction is endothermic</p> <p>IGNORE any references to Le Chatelier's Principle (moves / shifts)</p> <p>M2 dep on M1 correct or missing</p>	2
(iv)	<p>M1 yield increases</p> <p>M2 there are more moles of (gaseous) reactants than products / there are fewer (gaseous) moles on the right hand side / there are 3 moles (of gas) on the left and 1 mole (of gas) on the right ORA</p>	<p>IGNORE any references to Le Chatelier's Principle (moves / shifts)</p> <p>M2 dep on M1 correct or missing</p>	2

<p>(b) (i)</p> <p>(ii)</p>	<p>M1 (bonds broken) = 436 + 436 + 1072 OR 1944</p> <p>M2 (bonds formed) = 414 + 414 + 414 + 358 + 463 OR 2063</p> <p>M3 1944 - 2063 (= - 119)</p> <p>an explanation that links together the following two points:</p> <p>M1 more energy is given out when the bonds are made</p> <p>M2 than is taken in when the bonds are broken ORA</p> <p>OR</p> <p>M1 breaking bonds is endothermic / takes in energy AND making bonds is exothermic / releases energy</p> <p>M2 the energy released is more than the energy taken in</p>	<p>IGNORE refs to numbers of bonds</p> <p>DEP on M1</p> <p>If state / imply that energy required to make bonds OR If state / imply that energy released when bonds are broken scores 0</p>	<p>3</p> <p>2</p>
<p>(c) (i)</p> <p>(ii)</p>	 	<p>REJECT -OH not displayed</p>	<p>1</p> <p>1</p>
			<p>Total 14</p>

