Mark Scheme (Results)

Summer 2023

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

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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.

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1 (a)</td><td><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></td><td>All 4 correct = (2)
2 or 3 correct = (1)
0 or 1 correct = (0)</td><td>2</td></tr>
<tr><td>(b) (i)</td><td>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</td><td></td><td>1</td></tr>
<tr><td>(ii)</td><td>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</td><td></td><td>1</td></tr>
<tr><td>(iii)</td><td>M1 Xe / xenon

M2 because it has a full outer shell (of electrons) / 8 electrons in the outer shell</td><td>M2 dep on M1

IGNORE refs to noble gas</td><td>2</td></tr>
<tr><td></td><td></td><td></td><td>Total 6</td></tr>
</table>

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td><table><tr><th>Physical state at room temperature</th><th>Colour</th></tr><tr><td>gas</td><td>pale green / yellow</td></tr><tr><td>gas</td><td>green</td></tr><tr><td>liquid</td><td>red-brown</td></tr><tr><td>solid</td><td>grey</td></tr></table></td><td></td><td>2</td></tr>
<tr><td>(b)</td><td>M1 bromine <u>water</u> / bromine <u>solution</u>

M2 turns colourless / decolourised</td><td>ALLOW <u>aqueous</u> bromine

IGNORE any starting colour

M2 is dep on mention of bromine in M1</td><td>2</td></tr>
<tr><td>(c)</td><td>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)</td><td>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</td><td>3</td></tr>
<tr><td></td><td></td><td></td><td>Total 7</td></tr>
</table>

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_3H_6 can be used to make (addition) polymers / plastics **M2** (because) they have double bonds / are unsaturated **M3** shorter alkanes / octane / C_8H_{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

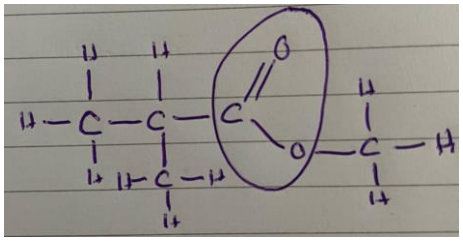
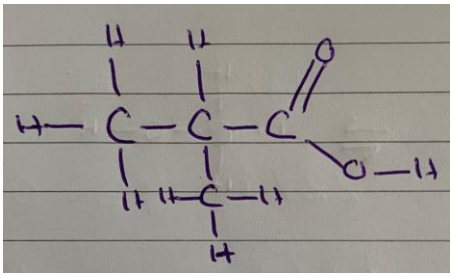
Question number	Answer	Notes	Marks
5 (a)	**M1** mix / react the two solutions (together)	IGNORE volumes IGNORE heating at this stage REJECT an indication that solids are mixed for **M1**	4
	M2 filter (the solid lead bromide)		
	M3 wash (using deionised water)	IGNORE any washing before filtering	
	M4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

(iii)	**M1** the conductivity decreases (when the volume of lead(II) nitrate added increases) **M2** there are fewer ions in the mixture	IGNORE proportional /inversely proportional REJECT directly proportional ACCEPT negative correlation between volume of lead(II) nitrate and electrical conductivity ALLOW the conductivity increases when the volume of lead(II) nitrate decrease ALLOW ions are being removed (as lead(II) bromide is formed)	2
(iv)	the student forgot to stir the mixture	ALLOW the student didn't allow enough time for the reaction to take place before measuring conductivity REJECT the student added less / too little lead(il) nitrate solution	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)	**M1** (electrostatic attraction between) <u>positive</u> ions **M2** (and) <u>delocalised</u> electrons	ACCEPT (electrostatic attraction between positive) nuclei of (metal) atoms REJECT any references to ionic bonding / sharing of electrons / intermolecular forces for both marks	2
(b) (i)	(squeaky) pop with lighted splint/lit with a (Bunsen) flame	IGNORE just 'burns with a squeaky pop' REJECT use of glowing splint	1
(ii)	any two from: **M1** lilac / purple flame **M2** potassium melts / turns into a ball **M3** potassium moves on the surface **M4** potassium gets smaller	 ALLOW flame REJECT other colours ALLOW floats ALLOW potassium disappears / dissolves IGNORE fizzing / bubbles etc	2
(c)	an explanation linking the following points: **M1** lithium has fewer shells than potassium **M2** <u>outer</u> shell / <u>outer</u> electron in lithium is more strongly attracted to the nucleus **M3** (so in lithium the outer shell) <u>electron</u> is less easily lost	 ALLOW lithium has smaller atoms than potassium ALLOW (outer shell) electron in lithium is closer to the nucleus ALLOW correct electron configurations REJECT 'fewer outer shells' ALLOW <u>outer</u> shell / <u>outer</u> electron in lithium is less shielded (by inner shells) ACCEPT valence electron ALLOW reverse argument throughout for potassium	3

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

Question number	Answer	Notes	Marks
7 (a) (i)	**M1** the forward and reverse reactions occur at the same rate		2
	M2 so the concentrations of reactants and products remain constant	ALLOW so the moles of reactants and products remain constant REJECT so the concentrations of reactants and products are the same	
(ii)	a catalyst increases the rate of (both) the forwards and the reverse reaction equally	ALLOW has the same effect on the rate of forward and reverse reaction	1
(iii)	**M1** yield increases		2
	M2 the (forward) reaction is exothermic	ALLOW the reverse reaction is endothermic IGNORE any references to Le Chatelier's Principle (moves / shifts) **M2** dep on **M1** correct or missing	
(iv)	**M1** yield increases		2
	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	IGNORE any references to Le Chatelier's Principle (moves /shifts) **M2** dep on **M1** correct or missing	

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

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