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Mark Scheme (Results)

January 2022

Pearson Edexcel International GCSE

In Chemistry (4CH1) Paper 1C and Science (Double Award) (4SD0) Paper 1C

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January 2022
Question Paper Log Number P70701A
Publications Code 4CH1_1C_2201_MS
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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.

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Question number	Answer	Notes	Marks
1 (a) (i)	chromatography		1
(ii)	fractional distillation		1
(iii)	simple distillation		1
(b)	M1 two / different elements M2 (chemically) joined / bonded together	ALLOW (two) different atoms ALLOW a description of bonding	2
(c) (i)	4		1
(ii)	20		1
			Total for question = 7 marks

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Question number	Answer	Notes	Marks
2 (a) (i)	M1 oxygen / air M2 water		2
(ii)	(hydrated) iron(III) oxide	REJECT (hydrated) iron (II) oxide	1
(iii)	C C is the correct answer because rusting involves the oxidation of iron. A is not the correct answer because the rusting of iron is not combustion. B is not the correct answer because the rusting of iron is not neutralisation. D is not the correct answer because the rusting of iron is not thermal decomposition.		1
(b) (i)	galvanising	ALLOW galvanisation IGNORE sacrificial protection	1
(ii)	M1 zinc is more reactive (than iron) M2 zinc reacts / oxidises / corrodes before / instead of iron	ALLOW zinc is higher in the reactivity series (than iron) REJECT references to zinc rusting	2
(iii)	Any two from: painting plastic coating oiling / greasing chromium plating sacrificial protection cathodic protection	 ALLOW powder coating	2
			Total for question = 9 marks

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Question number	Answer	Notes	Marks
3 (a)	solid to liquid **melting** solid to gas **sublimation** liquid to solid **freezing**		3
(b) (i)	diffusion	ALLOW diffusing	1
(ii)	Any one from: ammonia travels further (in the same time) the ammonium chloride / (white) ring / solid forms further away from the ammonia the ammonium chloride / (white) ring / solid forms closer to the hydrochloric acid		1
(iii)	Any one from: gas particles move in random directions gas particles collide with air particles / each other gas particles collide with the wall of the tube		1
(iv)	Any one from: eye protection / wear safety glasses / goggles wear gloves apron / lab coat	ALLOW put a bung / cork in both ends	1
			Total for question = 7 marks

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Question number	Answer	Notes	Marks
4 (a) (i)	Any one from: to increase the rate of reaction to give the particles enough energy to react	 ALLOW because copper does not react with oxygen when copper is cold ALLOW so that copper will react with oxygen	1
(ii)	because Ar does not (readily) gain / lose / share electrons	ACCEPT argon has a full outer shell / valence shell of electrons	1
(iii)	copper(II) oxide	ALLOW copper oxide REJECT copper(I) oxide	1
(b) (i)	results are the same (at the end)	ALLOW results stop decreasing	1
(ii)	M1 volume oxygen = 20 cm^3 M2 total volume = 253 cm^3 M3 (20÷253)×100 = 7.9%	 ALLOW correct evaluation from M1 and M2 ALLOW any number of significant figures REJECT incorrect rounding Correct answer of 7.9% with or without working scores 3	3
(iii)	Any one from: there is a leak in the apparatus temperature was not the same for all readings the apparatus was not left to cool (to room temperature)	 IGNORE not all oxygen reacted	1
			Total for question = 8 marks

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Question number	Answer	Notes	Marks
5 (a) (i)	relative mass proton 1 relative mass neutron 1 relative charge proton +1 relative charge neutron 0	All 4 correct scores 2 2 or 3 correct scores 1	2
(b) (i)	M1 <u>atoms</u> (of the same element) with the same number of protons	ALLOW <u>atoms</u> with the same atomic number ALLOW <u>atoms</u> with the same number of electrons	2
	M2 but different numbers of neutrons	ALLOW but different mass numbers	
(ii)	M1 number of protons and electrons = 12 M2 number of neutrons = 14		2
(iii)	$\frac{(24 \times 79) + (25 \times 10) + (26 \times 11)}{100}$ scores 2 marks M1 multiplies each mass number by the percentages M2 adds multiples together and divides by 100	(24 x 0.79) + (25 x 0.10) + (26 x 0.11) scores both marks	2
(iv)	M1 $24.32 \div (6.022 \times 10^{23})$ M2 4.039×10^{-23}	ALLOW ecf from M1 as long as answer is given to 4 sig figs Correct answer of 4.039×10^{-23} g to 4 sig sigs scores 2 with or without working	2
(c)	(moles of MgO) = 0.40		1
			Total for question = 11

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Question number	Answer	Notes	Marks
6 (a)	Any three from: M1 sodium (atom) loses electron(s) M2 oxygen (atom) gains electron(s) M3 sodium loses 1 electron AND oxygen gains 2 electrons OR M3 (both atoms become ions with configuration) 2.8	any mention of sharing of electrons scores 0	3
(b)	62		1
(c)	Any two from: M1 (sodium oxide has) ions / (giant) ionic structure M2 ions / electrons cannot flow / move M3 no delocalised electrons		2
(d)	M1 flame test M2 yellow colour	ALLOW any description of a flame test ALLOW orange or yellow-orange M2 dep on M1 or mention of flame	2
(e)	$2Na_2O \rightarrow 2Na + Na_2O_2$		1
			Total for question = 9 marks

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Question number	Answer	Notes	Marks
7 (a)	C C is the correct answer because a precipitate of calcium sulfate will form in tube 1, no precipitate will form in tube 2 as both products are soluble in water and a precipitate of copper(II) carbonate will form in tube 3. A, B and D are not the correct answers as no precipitate will form in tube 2.		1
(b) (i)	white		1
(b) (ii)	Any five from:		5
	M1 filter		
	M2 heat/boil (the solution)		
	M3 to evaporate some of the water	ALLOW until crystals form on the end of a glass rod ALLOW until crystals first start to form ALLOW until the solution is saturated	
	M4 leave / cool (to crystallise)	M4 dep on M2	
	M5 pour off excess liquid **OR** filter (to obtain crystals)	M5 dep on crystals having been formed IGNORE references to washing	
	M6 suitable method of drying the crystals	e.g. place in (warm) oven / leave to dry (in warm place) / use filter paper / kitchen towel / / desiccator If solution heated to dryness or left to evaporate all of the water only M1 and M2 can be awarded. If method produces silver chloride only M1 and M6 can be awarded	
(iii)	any one from:		1

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	to make sure the silver nitrate and sodium chloride fully reacted to make sure the products only contained silver chloride and sodium nitrate to ensure the highest possible yield	ALLOW so all the reactants react OR so nothing left unreacted OR so neither reagent is in excess ALLOW to make sure the sodium nitrate (crystals) would be pure ALLOW If either solution were in excess, it would contaminate the sodium nitrate OWTTE	
			Total for question = 8 marks

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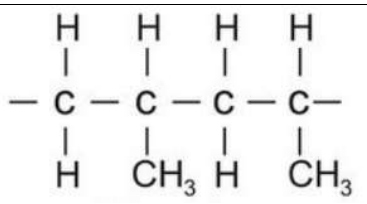
Question number	Answer	Notes	Marks
8 (a) (i)	A		1
(ii)	C		1
(iii)	propene		1
(iv)	M1 same molecular formula M2 different structural / displayed formulae		2
(b) (i)	$CH_3Br + HBr$	ALLOW balanced equations for multiple substitutions	1
(ii)	substitution		1
(c) (i)	M1 37.8÷12, 6.3÷1, 55.9÷35.5 M2 3.15, 6.3, 1.57 M3 divide by smallest to get 2:4:1 **OR** M1 M_r of C_2H_4Cl = 63.5 M2 24/63.5 x 100 and 4/63.5 x 100 and 35.5/63.5 x100 M3 37.8% and 6.3% and 55.9%	M2 subsumes M1 M3 must be calculated	3
(ii)	M1 127÷63.5=2 M2 Molecular formula = $C_4H_8Cl_2$	Answer of $C_4H_8Cl_2$ without working scores 2	2
(d) (i)	 M1 two carbon atoms both with 2 H atoms M2 two carbon atoms both with 1 H atom and 1 CH_3 group and nothing attached to the joining bonds	Marks are independent	2
(ii)	Any one from:		1

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	landfill sites are getting full toxic / greenhouse gases are produced when burned		
			Total for question = 15 marks

Question number	Answer	Notes	Marks
9 (a)	M1 to prevent acid splashing out OR so only (carbon dioxide) gas leaves the flask M2 so the decrease in mass is close to the actual value OR so that the decrease in mass is only due to the gas	IGNORE solid leaving the flask REJECT prevents gas escaping	2
(b)	M1 $CaCO_3$(s) + 2HCl(aq) M2 H_2O(l) + CO_2(g)		2
(c) (i)	the hydrochloric acid has all reacted		1
(ii)	mass stays the same / stops decreasing	ALLOW effervescence / fizzing stops ALLOW the curve levels off	1
(iii)	M1 0.98 M2 (0.98÷44) = 0.022	ALLOW any number of significant figures REJECT incorrect rounding ALLOW M1÷44 Correct answer of 0.022 moles with or without working scores 2 marks	2
(iv)	M1 tangent shown on graph M2 method of calculating gradient (change in y ÷ change in x) M3 rate of reaction in g/s	ALLOW ECF from M2 Answer of 0.005 – 0.006 with a tangent shown on the graph scores 3 with or without other working.	3

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		Answer of 0.015g/s (the average rate of reaction for the first 60s scores 1)	
(d) (i)	M1 the rate of reaction increases as the percentage concentration increases M2 the rate of reaction is (directly) proportional to the percentage concentration	 M2 subsumes M1	2
(ii)	M1 change in number of particles (per unit volume)	ALLOW particles are closer together or further apart	2
	M2 change in collisions per unit time	ALLOW change in frequency of collisions REJECT increased / changed energy / speed	
			Total for question = 15 marks

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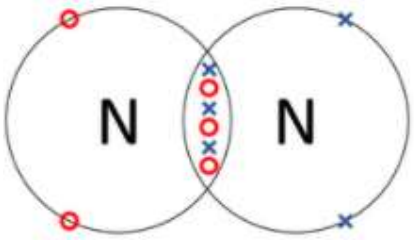
Question number	Answer	Notes	Marks
10 (a) (i)		ALLOW dots, crosses or any combination.	2
	M1 6 bonding electrons		
	M2 2 non-bonding electrons on each atom	M2 dep on M1	
(ii)	M1 shared pair(s) of electrons		2
	M2 attracted to (two) nuclei	REJECT nucleus. Must be plural for M2. M2 dep on mention of electrons in M1	
(b) (i)	diamond		1
(ii)	Any four from:		4
	M1 graphite is giant covalent	ALLOW giant structure if M2 is scored REJECT molecules of graphite	
	M2 (in melting graphite) covalent bonds are broken	ALLOW description of covalent bonds	
	M3 (C_{60}) (simple) molecular structure	ALLOW molecules of C_{60}	
	M4 (in melting C_{60}) intermolecular forces (of attraction) are overcome	ALLOW breaking bonds in C_{60} if intermolecular forces clearly mentioned M4 subsumes M3	
	M5 more energy is needed to break covalent bonds (in graphite) than intermolecular forces (in C_{60})	Mention of intermolecular forces in graphite no M2 or M5	

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		Mention of breaking covalent bonds in C_{60} no M4 or M5	
			Total for question = 9 marks

Question number	Answer	Notes	Marks
11 (a) (i)	M1 add anhydrous copper sulfate M2 turns (from white) to blue	ALLOW add white copper sulfate M2 dep on copper sulfate in M1 ALLOW M1 add anhydrous / blue cobalt chloride M2 turns (from blue) to pink M2 dep on cobalt chloride in M1	2
(ii)	M1 measure the boiling point / freezing point M2 100 °C / 0°C	ALLOW boil it or freeze it Value must match property	2
(b)	M1 mass of hydrated zinc sulfate = 54.46-41.64 **OR** 12.82 g M2 Moles of hydrated zinc sulfate = 12.82÷287 **OR** 0.0447 M3 Moles H_2O = 0.0447×7 **OR** 0.313 M4 Mass H_2O = 5.63 g M5 Volume H_2O 5.6 cm^3	 ALLOW M1÷287 ALLOW M2×7 ALLOW M3×18 Must be 1dp ALLOW M4 to 1dp Correct answer of 5.6 cm^3 to 1dp with or without working scores 5 marks	5
(c) (i)	1.7	ALLOW 2 or more significant figures REJECT incorrect rounding	1
(ii)	M1 stand the measuring cylinder in a beaker of ice OR	ALLOW any way of cooling the measuring	2

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		cylinder or delivery tube	
	M1 replace the delivery tube with a (Liebig) condenser	ALLOW add a condenser IGNORE add a stopper / bung	
	M2 less water / water vapour / steam lost	ALLOW more water (vapour) / steam condenses ALLOW less water evaporates	
			Total for question = 12

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