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Mark Scheme (Results)

January 2023

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

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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)	name of the part of this atom labelled A nucleus number of the group that contains this element 2 number of the period that contains this element 3		3
(b) (i)	4		1
(ii)	(species X has) three more protons than electrons / three fewer electrons than protons	ALLOW (the atom which formed species X has) lost three electrons IGNORE refs to Group 3	1
(iii)	M1 same number of protons / both have 17 protons M2 different number of neutrons / one has two neutrons more / one has 18 neutrons and the other has 20 neutrons	IGNORE all refs to electrons ALLOW "same atomic number, different mass number" for (1) mark	2
			Total for question = 7

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Question number	Answer	Notes	Marks
2 (a) (i)	B A, C and D are not the correct answers as metals conduct electricity when solid		1
(ii)	D A is not the correct answer because diamond will not conduct electricity when molten B is not the correct answer because diamond will not conduct electricity when solid or molten C is not the correct answer because diamond has a much higher melting and boiling point		1
(iii)	C A is not the correct answer as A is a solid at 600°C B is not the correct answer as B is a liquid at 600°C D is not the correct answer as D is a solid at 600°C		1
(b) (i)	5/five		1
(ii)	32/thirty two		1
			Total for question = 5

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Question number	Answer	Notes	Marks
3 (a)	B A is not correct because mixing sodium sulfate and potassium nitrate does not produce an insoluble salt. C is not correct because mixing sodium chloride and ammonium nitrate does not produce an insoluble salt. D is not correct because mixing sodium hydroxide and potassium sulfate does not produce an insoluble salt.		1
(b)	M1 filter (the solid lead sulfate) M2 wash / rinse (with deionised / distilled water) M3 leave (in a warm place) to dry	If the method starts with crystallisation then, max (2) ALLOW leave on a windowsill / dry using filter paper / dry in a (warm / drying) oven If the reaction mixture is just heated to dryness, score M3 only	3
(c) (i)	6 points plotted ± half a square		1
(ii)	smooth curve of best fit through, or within a square, of all points		1
(iii)	M1 working shown on graph M2 solubility at 90°C – solubility at 30°C	ALLOW any evidence of temperatures marked on graph eg dots / lines Expected answer of 74-82 scores 2 <u>provided some working is shown on graph</u> If no working shown, score M2 only Mark ECF on (ii), even if a straight line is drawn	2
			Total for question = 8

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Question number	Answer	Notes	Marks
4 (a) (i)	M1 crude oil is heated / vapourised M2 vapours / gases / compounds / hydrocarbons rise up the column M3 the column is hotter at the bottom than the top M4 vapours / compounds / hydrocarbons condense at their **boiling** point	ALLOW boiled REJECT burned ALLOW temperature gradient of the column ALLOW different temperatures at each level ALLOW fractions with lowest boiling point rise to the top IGNORE refs to gradient in density of molecules ALLOW vapours / compounds / hydrocarbons / condense at different heights ALLOW the vapours / compounds / hydrocarbons / fractions have different boiling points IGNORE melting point	4
(ii)	kerosene = aeroplane <u>fuel</u> / <u>fuel</u> for heating bitumen = road tar / tarmac / (waterproofing) roofs	ALLOW <u>fuel</u> for lamps / <u>fuel</u> for cooking ALLOW road surfacing / road making	2
(b) (i)	M1 breaking down long-chain <u>hydrocarbons</u> / long-chain <u>molecules</u> / long-chain <u>alkanes</u> M2 to form shorter chains (of alkanes / alkenes / hydrocarbons)	REJECT polymers IGNORE refs to separation ALLOW to break (C-C) bonds	2
(ii)	M1 (ethene is unsaturated because it has a) double (C=C) bond M2 (ethene is a hydrocarbon as it contains) hydrogen and carbon (atoms) M3 only	 REJECT carbon and hydrogen molecules M3 dep on mention of carbon and hydrogen in M2	3

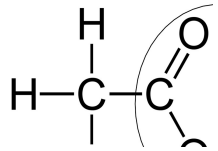
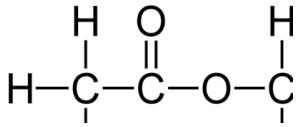
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(iii)	M1 add bromine water M2 which decolourises / turns colourless	ALLOW bromine solution NOT just 'bromine' M2 dep on mention of bromine in M1 IGNORE starting colour of bromine IGNORE clear NOT just 'changes colour' If reaction takes place in presence of uv, then score M1 only	2
			Total for question = 13

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Question number	Answer	Notes	Marks
5 (a)	M1 layers / rows of atoms / (positive) ions M2 can slide over one another	REJECT molecules IGNORE refs to electrons	2
(b) (i)	M1 ions M2 can move	REJECT electrons M2 dep on ions in M1	2
(ii)	M1 positive sodium **ions** / cations / Na^+ (ions) are attracted (to the negative electrode) M2 where they gain electrons OR where they are reduced	ALLOW move REJECT atoms / metal ALLOW balanced ionic equation ($Na^+ + e \rightarrow Na$)	2
(iii)	$2Cl^- \rightarrow Cl_2 + 2e^-$	ALLOW $2Cl^- - 2e^- \rightarrow Cl_2$	1
(iv)	sodium is more reactive (than hydrogen) / higher in the reactivity series (than hydrogen)	ALLOW (in aqueous solution) hydrogen ions are discharged / hydrogen is produced	1
(c)	M1 mass of copper = 3.81g and mass of oxygen = 0.96g M2 moles of copper = 0.06 and moles of oxygen = 0.06 M3 ratio = 1:1	 M2 allow ECF from M1 but only if A_r for copper and oxygen are used M3 dep on M1 and M2 but must be 1:1 ratio IF A_r is divided by mass, then M1 only scores	3
			Total for question = 11

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Question number	Answer	Notes	Marks
6 (a) (i)		REJECT more than one molecule or group circled	1
(ii)	 M1 ester linkage (COO) correctly displayed M2 rest of the molecule correct	M2 dep on M1	2
(iii)	ethyl ethanoate		1
(b)	M1 the forwards and the reverse reactions occur at the same rate M2 the concentrations of reactants and products remain constant	REJECT concentrations of reactants and products are the same ALLOW amounts	2
(c) (i)	(concentrated) sulfuric acid /it is a catalyst		1
(ii)	Any 6 of the following: M1 rinse the burette <u>with sodium hydroxide</u> M2 fill the burette <u>with sodium hydroxide</u> M3 make sure that the jet / space between tap and tip contains liquid M4 add (a few drops) of indicator (to the conical flask) M5 add (sodium hydroxide) from the burette until the indicator changes colour (permanently) M6 swirl the conical flask M7 add (sodium hydroxide) dropwise close to the endpoint M8 record initial and final volume on burette M9 repeat until concordant results	ALLOW no bubbles in the burette ALLOW any named indicator except universal indicator ACCEPT <u>any</u> stated colour change ACCEPT shake ALLOW record volume of solution added ALLOW repeat until two results are ± 0.2 cm^3	6
			Total for question = 13

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Question number	Answer	Notes	Marks
7 (a)	M1 two electrons between nitrogen and each of the four hydrogen atoms M2 two electrons between the two nitrogen atoms, and a non-bonding pair on each nitrogen	ALLOW any symbols used for electrons ALLOW each non-bonding pair shown as two separate electrons	2
(b) (i)	M1 (3×158)+(12×391) M2 5166 kJ	 5166 kJ without working scores 2 IGNORE sign of final answer	2
(ii)	M1 (12×391)+945 M2 5637kJ	 5637 kJ without working scores 2 IGNORE sign of final answer	2
(iii)	−471 (kJ/mol)	ECF on b(i) & b(ii) If final answer is +ve do not penalise lack of sign	1
(iv)	An explanation that links together the following two points: M1 bond breaking requires energy / is endothermic, bond formation releases energy / is exothermic M2 more energy released than taken in / making bonds involves more energy than breaking bonds	 “bonds” only needs mentioning once “more energy is given out when bonds are made than is taken in when bonds are broken” scores (2)	2
(c)	M1 amount of nitrogen gas = 1570÷24000 **OR** 0.06542 (mol) M2 amount of ammonia = 0.0654×4 **OR** 0.2617 (mol) M3 concentration of ammonia = 0.2617 ÷ 1100x1000 = 0.237878…. M4 0.238 (mol/dm^3) *	 ALLOW M1×4 ALLOW M3÷1.1 Must be 3 sig figs to score M4 answer of 0.238 (mol/dm^3) scores 4 marks with or without working	4
			Total for question = 13

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