Mark Scheme (Results)

January 2019

Pearson Edexcel International GCSE

In Chemistry (4CH0) Paper 1C

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January 2019
Publications Code 4CH0_1C_1901_MS

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.

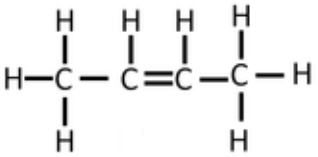
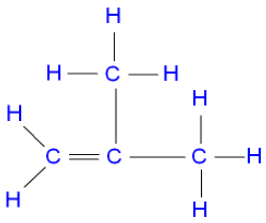
Question number	Answer	Notes	Marks
1 (a)	M1 melting M2 evaporation M3 sublimation		3
(b)	Any three from M1 (Arrangement of particles) irregular M2 large gaps between them /far apart /widely spaced M3 random movement / move freely M4 move (very) quickly	 ALLOW spread out IGNORE references to kinetic energy	3

Total for Question 1 = 6 marks

Question number	Answer	Notes	Marks
2 (a)	M1 tripod M2 Y (filter) funnel M3 Z evaporating basin/dish	ACCEPT correct labelling on diagram if answers not on answer lines ALLOW evaporating bowl	3
(b)(i)	M1 so the sodium chloride/salt dissolves M2 (more) quickly	REJECT so the rock salt dissolves IGNORE references to increased rate of reaction M2 dep on mention of dissolving in M1	2
(ii)	**D** a solvent		1
(c)(i)	M1 impurities remain in filter paper/funnel M2 because they are insoluble / do not dissolve	ALLOW impurities are filtered out/off /are the residue ACCEPT because the particles are too large to pass through (filter paper)	2
(ii)	**C** a solution		1

Total for Question 2 = 9 marks

Question number	Answer	Notes	Marks
3 (a) (i)	fractional distillation	ALLOW fractionation /fractionating REJECT distillation on its own	1
(ii)	kerosene - fuel for aircraft / heaters / lamps bitumen - roads / roofing	ALLOW paraffin heaters/lamps	2
3 (b) (i)	M1 alkanes M2 (because) $C_{20}H_{42}$ fits general formula of alkanes/C_nH_{2n+2}	 ALLOW contains no double bonds / has only single bonds / saturated hydrocarbon IGNORE reference to name ending	2
(ii)	silica or alumina	ACCEPT silicon dioxide/ aluminium oxide/ alumino-silicates /zeolites ACCEPT correct formulae i.e. SiO_2 / Al_2O_3	1
(iii)	$C_{20}H_{42} \rightarrow 3C_4H_8 + \mathbf{C_8H_{18}}$	Penalise incorrect use of case, superscripts etc.	1

Question number	Answer	Notes	Marks
(c) (i)	M1 consists of hydrogen/H and carbon/C (atoms)	REJECT hydrogen and carbon molecules REJECT atom/mixture containing H and C	2
	M2 only	M2 dep on hydrogen and carbon in M1	
(ii)	Contains **only** (carbon-carbon) single bonds	ALLOW does not contain double /multiple bonds	1
(iii)	M1 bromine (water)	ACCEPT use of $KMnO_4$	3
	M2 with unsaturated goes colourless / decolourises	IGNORE clear /discoloured If initial colour stated must be correct. ACCEPT any combination of brown/orange/yellow	
	M3 with saturated no change /stays orange	ACCEPT any combination of brown/orange/yellow	
(d) (i)	but-1-ene	ACCEPT 1-butene ALLOW 1-butylene	1
(ii)	 OR 	ALLOW cyclobutane ALLOW methyl cyclopropane	1

Total for Question 3 = 15 marks

Question number	Answer	Notes	Marks
4 (a) (i)	M1 (electrostatic) attraction between bonding/shared pair of electrons and M2 (both) nuclei of atoms (in the bond) OR M1 bonding /shared pair of electrons M2 attracted to (both) nuclei of atoms (in the bond)	No M2 if reference to just one nucleus No M2 if reference to just one nucleus	2
(ii)	M1 two shared pairs of electrons between two carbon atoms M2 rest of molecule correct	ALLOW any combination of dots and crosses. M2 dep on M1	2
(b) (i) Clip together	M1 intermolecular forces (of attraction) /(attractive) forces between molecules are weak M2 little (heat/thermal) energy required to overcome these forces	ALLOW weak intermolecular bonds /weak bonds between molecules IGNORE less energy ALLOW bonds for forces if intermolecular mentioned or implied in M1 0 marks if implied that covalent bonds break	2
(ii)	(in B) stronger forces (of attraction) (between molecules than in A)	ALLOW bonds for forces if intermolecular mentioned in (i) ALLOW molecules of B are larger than those of A	1

		ALLOW the relative formula mass of B is greater than that of A	
(iii)	M1 58/[(2x12) + (5x1)] or 58/29 (= 2) M2 C_4H_{10}	Correct answer alone scores 2 marks	2
(c)	M1 giant (covalent structure) EITHER M2 many/ strong (covalent) bonds need to be broken OR M3 large amount of (heat/thermal) energy needed to break the bonds	REJECT giant bond No M2 or M3 if reference to intermolecular forces	2

Total for Question 4 = 11 marks

Question number	Answer	Notes	Marks
5 (a)	(burns with a) blue flame		1
(b)	$2HCl + Na_2SO_3 \rightarrow 2NaCl + SO_2 + H_2O$ M1 all correct formulae M2 balancing correct	ACCEPT multiples or fractions IGNORE state symbols even if incorrect M2 dep on M1	2
(c) (i)	to dry the gas	ACCEPT to remove/absorb water	1
(ii)	downward delivery	ACCEPT upward displacement of air ALLOW downwards collection	1
(iii)	denser than air	IGNORE heavier than air/ denser than oxygen	1
(d) (i)	sulfurous (acid) / H_2SO_3	ALLOW sulfuric acid /H_2SO_4 if name and formula given both must be correct	1
(ii)	red / pink		1

(iii)	H^+	ACCEPT H_3O^+	1
(iv)	orange	ALLOW yellow	1

Total for Question 5 = 10 marks

Question number			Answer	Notes	Marks
6	(a)		$Mg(\mathbf{s}) + 2HCl(\mathbf{aq}) \rightarrow MgCl_2(\mathbf{aq}) + H_2(\mathbf{g})$	ACCEPT upper case letters	1
	(b)	(i)	to make the reaction faster OWTTE OR oxide layer slows down/affects rate of reaction OWTTE	ACCEPT so magnesium can react (with the acid straight away) ACCEPT oxide layer stops magnesium from reacting (with the acid straight away)	1
		(ii)	so little gas/hydrogen escapes OWTTE	REJECT references to stopping substances entering the flask	1
		(iii)	at same time / as soon as bung put into flask OWTTE	ACCEPT as soon as gas syringe is connected	1
	(c)	(i)	M1 22(cm^3) M2 vertical line drawn to touch curve at t = 1 minute Or horizontal line drawn to touch curve at t = 1 minute	 ALLOW cross drawn at correct point on graph	2
		(ii)	5.3 (min)	Accept values in range 5.2 to 5.4	1
		(iii)	M1 all magnesium reacted/used up M2 all (hydrochloric) acid reacted/used up	 ALLOW both/all reactants used up for 1 mark	2
		(iv)	M1 at start (of reaction)/during the first minute M2 as graph/curve steepest /gradient greatest	ACCEPT initially ALLOW references to acid most concentrated /most	2

		reactants present /most particles present/ most gas is produced	
(d)	M1 rate increases M2 more particles in same volume M3 so more (successful) collisions M4 per unit time	 ACCEPT particles closer together more frequent collisions scores M3 and M4 If reference to gaining energy MAX 1	4

Total for Question 6 = 15 marks

Question number	Answer	Notes	Marks
7 (a) (i)	the greater the relative atomic mass the higher the boiling point ORA	ALLOW positive correlation	1
(ii)	do not (easily) gain/lose/share electrons	ALLOW full outer shell /energy level (of electrons)	1
(b)	all have seven/same number of electrons in outer/valence shell/outer energy level	ALLOW all need to gain one electron to have a full outer shell ALLOW all their electron configurations end with 7	1
(c) (i)	$Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$	ALLOW fractions /multiples IGNORE state symbols even if incorrect	1
(ii)	orange	ALLOW brown / yellow / any combination of brown/orange/yellow	1
(iii)	M1 no reaction as bromine less reactive than chlorine ORA M2 so bromine cannot displace chlorine	Penalise incorrect use of chloride once only	2
(iv)	M1 iodide (ions)/I^- lose electrons so oxidised M2 chlorine/Cl_2 gains electrons so reduced	REJECT reference to iodine instead of iodide	2

		OR M1 iodide (ions)/I^- oxidised and chlorine/Cl_2 reduced M2 iodide (ions)/I^- lose electrons and chlorine/Cl_2 gains electrons	If incorrect reference to iodine in either or both M1 and M2 MAX 1 mark IGNORE both oxidation and reduction occur (in the same reaction)	
7 (d)	(i)	$H_2 + Cl_2 \rightarrow 2HCl$	ALLOW fractions/multiples IGNORE state symbols even if incorrect	1
	(ii)	M1 (beaker A) litmus stays blue/no change to litmus M2 hydrogen chloride does not ionise /does not form H^+ ions / remains as molecules /does not form hydrochloric acid M3 (beaker B) litmus turns red M4 (hydrogen chloride forms) hydrogen ions /H^+ ions/hydrochloric acid (forms)	ALLOW litmus turns blue ALLOW does not dissociate No M1 if references to methylbenzene/solution being alkaline or methylbenzene reacting REJECT litmus paper turns red and then bleaches IGNORE acidic solution /acid forms	4

Total for Question 7 = 14 marks

Question number	Answer	Notes	Marks
8 (a) (i)	M1 not making a valid conclusion because could also be zinc or aluminium ions /could be any of the three ions M2 because not seen effect of adding excess sodium hydroxide OWTTE	ACCEPT zinc and aluminium also/all three ions form white precipitates	2
(ii)	M1 flame (test) M2 brick red/ orange-red	ALLOW description of flame test IGNORE burn it/heat it IGNORE red or orange alone M2 dep on M1 or mention of flame in M2	2
(b) (i)	M1 reheat/heat again (and reweigh) M2 until constant mass (achieved)	Heat to constant mass scores M1 and M2	2
(ii)	M1 mass(H_2O) = (6.1 – 5.2) = 0.9 (g) M2 $n(AB_2)$ = 5.2 ÷ 208 AND $n(H_2O)$ = 0.9 ÷ 18 M3 ratio of AB_2 to H_2O is 0.025:0.05/1:2 M4 x = 2	M3 subsumes M2 accept $AB_2.2H_2O$	4
8 (c)	M1 add nitric acid/HNO_3 M2 add silver nitrate (solution)/$AgNO_3$ M3 white precipitate forms	If incorrect acid or an alkali added then M2 and M3 can be scored M3 dep on addition of silver nitrate	3

		If any other incorrect reagent added e.g. barium chloride then only M1 can be scored	
(d) (i) clip	[208 – (2x35.5) =] 137		1
(ii)	A is barium/Ba	ALLOW Ba^{2+} ALLOW ECF from an incorrect calculation if answer is a group 2 metal or d block metal	1

Total for Question 8 = 15 marks

Question number	Answer	Notes	Marks
9 (a) (i)	haematite	ACCEPT any correct ore of iron e.g. magnetite IGNORE name of/formula of iron oxide in any oxidation state	1
(ii)	M1 to provide oxygen/O_2		2
	M2 to react with /oxidise carbon/coke/C	ALLOW to form CO/CO_2	
(iii)	**2**Fe_2O_3 + **3**C → **4**Fe + **3**CO_2	ALLOW fractions /multiples	1
(iv)	M1 limestone/calcium carbonate decomposes to form CaO	ACCEPT $CaCO_3$ → CaO + CO_2	3
	M2 calcium oxide/CaO reacts with silica/SiO_2 /sand	$CaO + SiO_2 \rightarrow CaSiO_3$ scores M2 and M3	
	M3 to form (molten) slag/calcium silicate		
(b) (i)	Aluminium is more reactive than carbon /higher in the reactivity series than carbon ORA		1
(ii)	Any 4 from		4
	M1 (aluminium extracted by) electrolysis		
	M2 (aluminium oxide) mixed with/added to cryolite		
	M3 (electrolyte) molten		
	M4 carbon/graphite electrodes (used)		
	M5 aluminium ions discharged/aluminium formed at negative electrode/cathode	ACCEPT Al^{3+} + 3e- → Al	

Total for Question 9 = 12 marks

Question number	Answer	Notes	Marks
10 (a) (i)	swirl flask	ALLOW shake/swish IGNORE stir	1
(ii)	Ticks under 23.15 22.95 and 23.10		1
(iii)	M1 (23.15 + 22.95 + 23.10) ÷ 3 M2 23.07	correct final answer with no working scores 2 If no results ticked in (ii), then only use of two or three concordant titres can score in (iii) If only one result ticked, M2 can be scored for correctly averaging 2 or more titre values. M1 CQ on results ticked M2 CQ on correct calculation from M1 Answer to M2 must be correct to 2dp	2

Question number	Answer	Notes	Marks
10 (b) (i)	M1 0.02270 x 0.080 **OR** $\frac{22.70 \times 0.080}{1000}$ M2 0.001816 / 1.816×10^{-3} (mol)	do not penalise missing trailing zeros 0.002 scores 1 mark only ACCEPT 1.816 for 1 mark Correct answer without working scores 2	2
(ii)	M2 from (i) x 2 / 0.003632 / 3.632×10^{-3} (mol)		1
(iii)	M1 answer from (ii) ÷ 0.025 / 0.003632 ÷ 0.025 **OR** M1 $\frac{\text{answer from (ii)} \times 1000}{25}$ M2 0.14528 / 1.4528×10^{-1} (mol/dm^3)	 ALLOW ECF only if division by 25 alone ACCEPT any number of sig fig except one Correct answer without working scores 2	2

Question number	Answer	Notes	Marks
10 (c)	M1 heat/boil until crystals form in a sample of solution that has been removed or cooled OWTTE	ACCEPT heat/boil to produce a (hot) saturated/concentrated solution ACCEPT heat/boil until crystals start to form ALLOW heat/boil to crystallisation point ALLOW (heat/boil to) evaporate some of the water IGNORE references to filtering before heating	4
	M2 cool/leave (the solution) until crystals form	M2 DEP on M1	
	M3 filter (to obtain the crystals)	M3 DEP on crystals having been formed ACCEPT decant/pour off the liquid/(excess) solution IGNORE references to washing crystals	
	M4 suitable method of drying the crystals	e.g. place in (warm) oven / leave to dry (in warm place) / use filter paper / kitchen towel REJECT any reference to heating directly with a flame eg Bunsen If solution heated to dryness or left to evaporate all of the water only 1 mark can be awarded.	

Total for Question 10 = 13 mark

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