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Mark Scheme (Results)

November 2020

Pearson Edexcel International GCSE In Chemistry (4CH1) Paper 1CR and Science (Double Award) (4SD0) Paper 1CR

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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)	simple distillation	**REJECT** fractional distillation **REJECT** distillation	1
(ii)	chromatography		1
(iii)	fractional distillation		1
(b)	**M1** dissolve **M2** solute **M3** solvent		3
			Total 6

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Question number	Answer	Notes	Marks
2 (a) (i)	Na/K	**ACCEPT** sodium/potassium	1
(ii)	He	**ACCEPT** helium	1
(iii)	Br	**ACCEPT** bromine **REJECT** bromide	1
(iv)	Na **and** Cl	**ACCEPT** sodium and chlorine **REJECT** chloride	1
(b)	2.8.1	**ACCEPT** 2,8,1 or 2 8 1 **ALLOW** diagram of atom showing correct electron configuration.	1 **Total 5**

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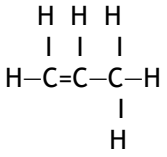
Question number	Answer	Notes	Marks
3 (a)	<table><tr><td>molecular formula</td><td>C_3H_6</td></tr><tr><td>name of this alkene</td><td>propene</td></tr><tr><td>empirical formula</td><td>CH_2</td></tr><tr><td>general formula</td><td>C_nH_{2n}</td></tr><tr><td>displayed formula</td><td></td></tr></table> 1 mark for each correct answer	**ACCEPT** propylene **ACCEPT** N or other letters e.g. x	4
b) i)	(contains a carbon carbon) double bond	**ACCEPT multiple bond**	1
ii)	M1 add bromine water M2 decolourises/changes to colourless	**REJECT bromine** **REJECT bromide** **ALLOW** turns colourless **IGNORE** clear **M2** dep **M1** or near miss	2
(c) (i)	$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$	**ACCEPT** multiples	1
(ii)	**D** Substitution A is incorrect as it is not an addition reaction B is incorrect as it is not a decomposition reaction C is incorrect as it is not a neutralisation reaction		1
(iii)	Ultraviolet radiation/light	**ACCEPT** UV/ultraviolet rays	1
(d) (i)	**M1** (isomers have) the same molecular formula **M2** (but) different structural/displayed formulae	 **ALLOW** different structures **ALLOW** different arrangement of atoms	2

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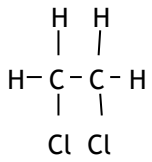
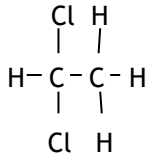
(ii)	**M1**			2
	M2			**Total 14**

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Question number			Answer	Notes	Marks
4	(a)		$2\ H_2O_2 \rightarrow 2\ H_2O + (1)\ O_2$	**ALLOW** multiples and fractions	1
	(b)		Relights a glowing splint/spill		1
	(c)		Speeds up/increases rate of the reaction	**IGNORE** references to lowering activation energy	1
	(d)	(i)	All points plotted correctly	**ALLOW** ± half a square	1
		(ii)	Point at 8 minutes circled		1
		(iii)	Smooth curve of best fit		1
		(iv)	took the reading too soon/before 8 minutes	**ACCEPT** misread the volume (of oxygen)	1
		(v)	**M1** vertical line on graph drawn to curve from 3 mins		2
			M2 value obtained from candidate's graph	Expected value 29 or 30 cm^3 **ALLOW** ± half a square	

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Question number	Answer	Notes	Marks
4 (e) (i)	**M1** curve drawn on graph that is less steep than curve of student's results.		2
	M2 curve levels off at 40 cm^3	**ALLOW** ± half a square	
(ii)	An explanation that links the following three points		3
	M1 reaction is slower		
	M2 fewer particles/molecules (in the same volume)	**ACCEPT** particles are further apart / less crowded	
	M3 fewer collisions per unit time	**ACCEPT** less frequent collisions **IGNORE** less chance of a collision	
			Total 14

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Question number	Answer	Notes	Marks
5 (a) (i)	6/six		1
(ii)	One of the following two points methanol/it) does not contain only carbon and hydrogen OR (methanol/it) contains (an atom of) oxygen		1
(b) (i)	**M1** two/ pair of electrons **M2** shared between two atoms	 **ACCEPT (electrons)** attracted to the nuclei (of the two atoms in the bond) **ACCEPT** **M1** (electrostatic) attraction between two nuclei **M2** (and the) shared pair(s) of electrons (between them)	2
(ii)	**M1** 4 pairs of electrons around central carbon atom, with one pair to O and 3 pairs to H **M2** rest of molecule fully correct	**ALLOW** any combination of dots and crosses **M2** DEP on **M1**	2

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Question number	Answer	Notes	Marks
5 (c) (i)	• Divide percentages by relative atomic masses • Divide results by smallest value to obtain ratio • Write empirical formula Example calculation **M1** C: $\frac{38.7}{12}$ H: $\frac{9.7}{1}$ O: $\frac{51.6}{16}$ **M2** $\frac{3.225}{(3.225)}$ $\frac{9.7}{(3.225)}$ $\frac{3.225}{(3.225)}$ **OR** 1 3 1 **M3** CH_3O	0 marks if division by atomic numbers or upside-down calculation **M2** subsumes **M1** **ACCEPT** symbols in any order	3
(ii)	• Divide relative molecular mass by empirical formula mass • Write molecular formula Example calculation **M1** $\frac{62}{12 + 3 + 16}$ **OR** $\frac{62}{31}$ (= 2) **M2** $C_2H_6O_2$	**ACCEPT** symbols in any order Correct answer without working scores 2 marks	2
			Total 11

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Question number	Answer	Notes	Marks
6 (a) (i)	halogens	**REJECT** halides	1
(ii)	(pale) green		1
(iii)	**M1** test with (damp) litmus paper **M2** bleaches	**ALLOW** (damp) universal indicator paper **ALLOW** turns white **IGNORE** turns red M2 dep on M1	2
(b)	A description that refers to the following three points **M1** add (dilute) nitric acid (to the unknown solution) **M2** add silver nitrate (solution) **M3** (pale) yellow precipitate	**M1** and **M2** can be in either order **REJECT** addition of incorrect acid **M3** dep on **M2**	3

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Question number	Answer	Notes	Marks
6 c	An explanation that links the following six points chlorine solution and potassium bromide solution **M1** (solution) turns orange	 **ACCEPT** yellow **REJECT** brown/red	6
	M2 (because) chlorine displaces bromine	**ACCEPT** correct word equation, balanced chemical equation or ionic equation.	
	M3 (so) chlorine is more reactive than bromine		
	bromine solution and potassium iodide solution **M4** (solution) turns brown		
	M5 (because) bromine displaces iodine	**ACCEPT** correct word equation, balanced chemical equation or ionic equation	
	M6 (so) bromine is more reactive than iodine	If incorrect use of chlori**d**e, bromi**d**e or iodi**d**e in any marking point deduct 1 mark. **ALLOW** 1 mark for correct order of reactivity given if **M3** and **M6** not scored	
			Total 13

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Question number	Answer	Notes	Marks
7 (a) (i)	Zn (s) + H_2SO_4 (aq) → $ZnSO_4$ (aq) + H_2 (g)	**ACCEPT** upper case letters	1
(ii)	effervescence/bubbles/fizzing	**ACCEPT** zinc gets smaller or disappears **IGNORE** hydrogen / gas produced / given off	1
(b) (i)	An explanation that links the following two points **M1** to make sure all of the acid reacts **M2** (so that) a pure zinc sulfate solution is obtained/pure zinc sulfate crystals are obtained OWTTE		2
(ii)	**M1** filter funnel containing filter paper **M2** suitable container to collect filtrate e.g. beaker, conical flask, evaporating basin	**M2** dep on a filter funnel in **M1**	2

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Question number	Answer	Notes	Marks
7 (c) (i)	• setting out of calculation • evaluation Example calculation **M1** 65 + 32 + (4 x 16) + (7 x 18) **M2** 287	correct answer without working scores 2	2
(ii)	• multiply moles by M_r • evaluation Example calculation **M1** (mass of $ZnSO_4.7H_2O$ =) 287 x 0.02(00) **M2** (mass of $ZnSO_4.7H_2O$ =) 5.74 (g)	correct answer (5.74) without working scores 2 **ALLOW** ecf from (i)	2
(iii)	**M1** 4.28÷5.74 OR 0.7456 **M2** 0.7456 × 100 **M3** 74.6	correct answer to 3 sig figs without working scores 3 **ALLOW** ecf from (ii) **ALLOW** use of 6g **ALLOW** any number of sig fig greater than 1 **ALLOW** use of 6g giving answer of 71.3 Must be 3 sig figs to score M3	3
			Total 13

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Question number	Answer	Notes	Marks
8 (a) (i)	**M1** white flame/light		2
	M2 white powder/solid (formed)	**ALLOW** white smoke **ALLOW** white ash **REJECT** white precipitate	
(ii)	magnesium gains oxygen	**ACCEPT** magnesium loses electrons/ oxidation state (of Mg) increases / goes from / changes from 0 to +2	1
(b) (i)	gives out/releases heat (energy)/thermal energy	**IGNORE** energy alone	1
(ii)	$2Mg + CO_2 \rightarrow 2MgO + C$	**ALLOW** multiples and fractions	1
(iii)	Any one from		1
	the fire would keep burning OR the carbon dioxide would not put out the fire OR a large amount of heat/thermal energy would be released	**ALLOW** Any other sensible suggestion	

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Question number	Answer	Notes	Marks
8 (c)	An explanation giving two linked changes **M1** (the student should) lift and replace the lid **M2** (to allow) oxygen/air to enter the crucible (to react with the magnesium) AND **M3** reheat and reweigh / heat to constant mass **M4** to make sure that all the magnesium has reacted		4 **Total 10**

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Question number	Answer	Notes	Marks
9 (a) (i)	**B** 5 A is incorrect as 1 is the pH of a strong acid C is incorrect as 7 is the pH of a neutral solution D is incorrect as 9 is the pH of a weak alkali		1
(ii)	**D** acids are proton donors A is incorrect as alkalis contain OH^- ions not acids B is incorrect as acids do not donate electrons C is incorrect as bases are proton acceptors not acids		1
(b) (i)	(thermal) decomposition		1
(ii)	$PbCO_3 \rightarrow PbO + CO_2$	**ALLOW** multiples	1

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Question number	Answer	Notes	Marks
9 (c) (i)	liquid (shown in table)	**ALLOW** if liquid written in space under question **ALLOW** l or L	1
(ii)	An explanation which links any six of the following points **M1** silicon dioxide has a giant (covalent) structure **M2** covalent bonds are (very) strong **M3** (in silicon dioxide) many/all the covalent bonds need to be broken **M4** a large amount of / more energy is required to break the bonds (in silicon dioxide) **M5** silicon(IV) chloride has a simple molecular structure **M6** the forces between the molecules/intermolecular forces (in silicon(IV) chloride) are weak **M7** little / less energy is needed to overcome the forces in silicon(IV) chloride	No **M3 or M4** if reference to overcoming / breaking intermolecular forces in silicon dioxide No **M6 or M7** if any reference to weak covalent bonds or breaking of covalent bonds in silicon(IV) chloride A statement such as 'more energy is needed to break the bonds in silicon dioxide than to overcome the forces in silicon(IV) chloride' scores **M4** and **M7**	6 **Total 11**

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Question number	Answer	Notes	Marks
10 (a) (i)	potassium hydroxide + hydrochloric acid → potassium chloride + water	**ALLOW** correctly balanced chemical equation	1
(ii)	**M1** to mix (the two solutions more thoroughly) **M2** (so that) more reactant particles come into contact with each other OWTTE **M3** so that the heat energy is given out more quickly OWTTE **M4** so that the mixture is the same temperature throughout OWTTE	ALLOW references to increasing rate of reaction	2
(b)	Correct answer with or without working scores 2 • setting out of calculation • evaluation Example calculation **M1** $\frac{17.8 + 18.4}{2}$ **M2** 18.1		2

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Question number	Answer	Notes	Marks
10 (c) (i)	Mean temperature at start in °C 17.2 Temperature at end in °C 22.4 Temperature rise in °C 5.2		2
(ii)	• calculation of volume/mass of mixture • substitution of values into $Q = mc\Delta T$ • evaluation Example calculation **M1** (volume/mass =) 25 + 25 **OR** 50 (cm^3) or (g) **M2** (Q =) 50 x 4.2 x 5.2 **M3** (Q =) 1092	 **ALLOW** ecf if 25 used in calculation 1092 without working scores 3 marks	3
(iii)	• division of Q by moles of KOH • conversion of J to kJ • answer with correct sign Example calculation **M1** $\frac{1092}{0.02}$ **OR** 54600 **M2** conversion from J to kJ OR 54.6(00) **M3** (ΔH =) − 54.6 (kJ/mol)	**ALLOW** ecf from answer to (ii) **ALLOW** any number of sig figs greater than 1 throughout **ACCEPT** 1092 or 1100 used in calculation **ALLOW** ecf from M1 Minus sign must be present **ALLOW** ecf from M2 **ACCEPT** any value between 54.5 and 55 **M3** dep on division of Q by moles	3

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		Correct answer with correct sign and without working scores 3 Correct answer without sign or with incorrect sign and without working scores 2.	**Total 13**

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