Mark Scheme (Results)

Summer 2018

Pearson Edexcel International GCSE in Chemistry (4CH0) Paper 1CR

Pearson Edexcel International in Science Double Award (4SC0) Paper 1CR

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Summer 2018
Publications Code 4CH0_1CR_1806_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	Marks
1		6

Information	Substance
a good conductor of electricity	copper
a noble gas	helium
a mixture	air
a liquid at room temperature	bromine
used in fire extinguishers	carbon dioxide/helium/nitrogen
used as a fuel	methane

Total for Question 1 = 6

Question number	Answer	Notes	Marks
2 (a)	Any 3 from M1 (moving) water particles/molecules bombard/collide with the sugar cube M2 sugar particles/molecules go into solution/dissolve M3 sugar particles/molecules spread out/diffuse/move randomly M4 (until) sugar particles/molecules are distributed evenly in the water	 ALLOW sugar particles move from area of high concentration to area of low concentration Max 2 if no reference to sugar particles/ molecules	3
(b) (i)	**B** distillation **A** is incorrect as the diagram does not show the apparatus used for crystallisation **C** is incorrect as the diagram does not show the apparatus used for filtration **D** is incorrect as the diagram does not show the apparatus used for sublimation		1
(ii)	**P** tripod **Q** gauze **R** condenser **S** conical flask	 ACCEPT wire gauze ALLOW condensing tube Do not allow just flask	4

Total for Question 2 = 8

Question number	Answer	Notes	Marks
3 (a)	pencil/it won't dissolve (in water/solvent)	ACCEPT ink/pen would/might dissolve (in water/solvent) ALLOW pencil won't separate (in the water) ALLOW ink would mix with the food colourings/water ALLOW ink would smudge/run/separate (in the water)/interfere with the results	1
(b) (i)	**D** contains only one colouring **A** is incorrect as drink A contains three colourings **B** is incorrect as drink B contains two colourings **C** is incorrect as drink C contains three colourings		1
(ii)	M1 C M2 spot moved the furthest/greatest distance	 ACCEPT has a spot nearest to water/solvent front ALLOW blob/dot/mark/point/colour/dye for spot M2 dep on M1 correct or missing	2

Question number	Answer	Notes	Marks
(iii)	M1 A <u>and</u> C M2 have spot at same level/travelled same distance	 ALLOW spots align/have same R_f values ALLOW blob/dot/mark/point/colour /dye for spot M2 dep on M1	2

Total for Question 3 = 6

Question number	Answer	Notes	Marks
4 (a)	proton 1 +1 neutron 1 0 electron 1/1836 -1 All 6 correct 3 marks 4 or 5 correct 2 marks 2 or 3 correct 1 mark	 ALLOW zero / neutral / no charge / none ALLOW 1/1800 to 1/2000 ALLOW 0.0005 to 0.00056 ALLOW negligible REJECT 0 / almost 0 Columns reversed MAX 1	3
(b) (i)	T	ALLOW Mg / magnesium	1
(ii)	T	ALLOW Mg / magnesium	1
(iii)	Q	ALLOW O^{2-} / oxide ion	1
(iv)	S	ALLOW F / fluorine	1
(c)	**D** the same number of protons **A** is incorrect as isotopes do not have a different atomic number **B** is incorrect as isotopes do not have a different number of electrons **C** is incorrect as isotopes do not have the same number of neutrons		1

Total for Question 4 = 8

Question number	Answer	Notes	Marks
5 (a) (i)	**A** atomic number **B** is incorrect as the elements in the Periodic Table are not arranged in order of increasing mass number **C** is incorrect as the elements in the Periodic Table are not arranged in order of increasing neutron number **D** is incorrect as the elements in the Periodic Table are not arranged in order of increasing relative atomic mass		1
(ii)	Phosphorus/P		1
(iii)	**Any two from**: **M1** carbon **M2** nitrogen **M3** fluorine	 ALLOWC/N/F ALLOW N_2/F_2 ALLOW boron/B ALLOW 1 mark for names/formulae of two correct acidic oxides	2

Question number	Answer	Notes	Marks
5 (a) (iv)	**M1** acid rain **M2** specified problem for environment caused by acid rain	ACCEPT makes lakes acidic / lowers pH of lakes IGNORE pollution **plants/trees/vegetation/crops/named example** dies/stunted growth/harmed/damaged/poisoned IGNORE deforestation/ leaching minerals **fish/aquatic animals/pond life/marine life/named example** dies/stunted growth /harmed /damaged /poisoned IGNORE references to just animals **limestone/marble** reacts/corrodes/is eaten away NOT just buildings IGNORE rusts or physical process such as erosion / weathering/ wearing away / dissolving ACCEPT destroys for adverse effect in all of above IGNORE respiratory problems IGNORE harmful/dangerous	2

Question number	Answer	Notes	Marks
5 (b) (i)	magnesium + sulfur → magnesium sulfide	ACCEPT sulphur ACCEPT magnesium sulphide REJECT magnesium sulf**ite** / magnesium sulf**ate**	1
(ii)	**M1** (each) magnesium/Mg (atom) loses two electrons /Mg (electronic configuration) changes from 2.8.2 to 2.8 **M2** (each) sulfur/S (atom) gains two electrons /S (electronic configuration) changes from 2.8.6 to 2.8.8 **M3** Mg^{2+} and S^{2-}	Mg transfers two electrons to S scores M1 and M2 ALLOW 1 mark for Mg loses electron(s) and S gains electron(s) No M1 or M2 if mention of electron sharing or covalent bonding ALLOW Mg (ion) has a charge of 2+/+2 and S (ion) has a charge of 2-/-2 Two correct ionic half equations scores all 3 marks Diagrams showing electron transfer and charges on the ions scores all 3 marks	3

Question number	Answer	Notes	Marks
5 (b) (iii)		Correct answer with no working or alternative correct working scores 3 marks	3
	M1 n(Mg) = 0.30/24 = 0.0125	**BUT** if atomic numbers used in M1 and M2 only M3 can be scored (for an answer of 0.7g)	
	M2 M_r (MgS) = 56		
	M3 mass MgS = 0.0125 x 56 = 0.7(0)g		
	OR		
	M1 Mr (MgS) = 56	ALLOW ECF if M1 and/or M2 incorrect	
	M2 (so) 24 (g Mg) gives 56 (g MgS)		
	M3 (so) 0.30 (g Mg) gives 56/24 x 0.3 = 0.7(0) g		
		ALLOW ECF for M2 and M3 if M1 incorrect	

Total for Question 5 = 13

Question number	Answer	Notes	Marks
6 (a)	$CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + CO_2 + H_2O$ **M1** all correct formulae **M2** correct balancing **M2** DEP on **M1**	ALLOW multiples IGNORE state symbols even if incorrect	2
(b) (i)	**M1** carbon dioxide/gas would escape through thistle funnel **M2** should collect by downward delivery /gas jar wrong way up OWTTE	ACCEPT end of thistle funnel should go into the acid ALLOW should be a tap on thistle funnel ACCEPT carbon dioxide/gas more dense than air so would not go into gas jar OWTTE IGNORE should collect gas over water / in a gas syringe	2
(ii)	**M1** calcium sulfate insoluble **M2** (calcium sulfate) forms coating on marble chips (and stops acid reacting with marble chips) OWTTE	ALLOW calcium sulfate only slightly soluble / is a precipitate ALLOW solid calcium sulfate produced	2

Question number	Answer	Notes	Marks
(c)	**C** weakly acidic **A** is incorrect because a solution with pH 6 is not weakly alkaline **B** is incorrect because a solution with pH 6 is not strongly alkaline **C** is incorrect because a solution with pH 6 is not strongly acidic		1

Question number	Answer	Notes	Marks
6 (d) (i)	**M1** (electrostatic) attraction between bonding/shared pair(s) of electrons **M2** and nuclei (of both atoms) **OR** **M1** bonding/shared pair(s) of electrons **M2** attracted to nuclei (of both atoms)	ALLOW electrostatic forces for attraction Do not award **M2** if reference to only one nucleus Do not award **M2** if reference to only one nucleus If the implication is that the shared pair of electrons is between molecules or ions rather than atoms scores 0 out of 2	2
(ii)	**M1** weak forces/attraction(s) between molecules / weak intermolecular forces **M2** (so) little (thermal/heat) <u>energy</u> required to overcome the forces /attraction(s) (between molecules) /separate the molecules	ALLOW weak bonds between molecules / intermolecular bonds ALLOW little energy needed to break the bonds if it is clear that they are referring to intermolecular forces IGNORE less energy required Any reference to weak covalent bonds / weak bonds between atoms **or** breaking of covalent bonds /breaking of bonds between atoms scores 0 out of 2	2

Question number	Answer	Notes	Marks
6 (d) (iii)	**M1** two pairs electrons between carbon atom and both oxygen atoms **M2** rest of molecule fully correct **M2** DEP on **M1**	ALLOW any combination of dots and crosses 	2

Total for Question 6 = 13

Question number	Answer	Notes	Marks
7 (a)	haematite		1
(b)	nitrogen	ACCEPT N_2 REJECT other gases	1
(c)	**M1** carbon reacts with oxygen to form carbon dioxide **M2** carbon dioxide reacts with carbon to form carbon monoxide	ACCEPT word or chemical equations for both marks ALLOW coke for carbon in M1 and M2 ALLOW carbon dioxide is formed by the decomposition of limestone/word or chemical equation to show this ALLOW (carbon monoxide is formed by) incomplete combustion of carbon/coke or chemical equation to show this for 1 mark Carbon reacts with oxygen alone is insufficient	2

Question number	Answer	Notes	Marks
7 (d)	$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$ **M1** correct formulae **M2** correct balancing **M2** dependent on **M1**	ACCEPT multiples and fractions	2

Total for Question 7 = 13

Question number	Answer	Notes	Marks
8 (a) (i)	thermometer	ALLOW Bunsen (burner)	1
(ii)	**M1** to cool the vapour(s)/gas(es) **M**2 (and) to condense it/turn it to liquid		2
(b) (i)	(Fraction) A	ALLOW **(**boiling point) 30-60	1
(ii)	(Fraction) A	ALLOW **(**boiling point) 30-60	1
(c) (i)	$C_{10}H_{22}$	Penalise incorrect use of case/superscripts etc	1
(ii)	C_nH_{2n+2}		1

Question number	Answer	Notes	Marks
8 (d) (i)	$C_{14}H_{30} \rightarrow C_8H_{18} + 2\ C_3H_6$ **M1** C_3H_6 **M2** fully correct equation	ALLOW $C_3H_6 + C_3H_6$ ALLOW 1 mark for $C_2H_4 + C_4H_8$ or C_6H_{12} in fully correct equation	2
(ii)	**M1** silica / alumina **M2** 600-700 (ºC)	ACCEPT aluminium oxide/silicon dioxide /Al_2O_3/SiO_2 / aluminosilicate(s)/zeolite(s) ACCEPT any temperature in the range 600 to 700 inclusive	2

Total for Question 8 = 11

Question number	Answer	Notes	Marks
9 (a) (i)	no change/no reaction OWTTE		1
(ii)	most sodium magnesium zinc least platinum	ACCEPT correct symbols	1
(iii)	(when mixed with air) burns with pop	Must be reference to test and result ACCEPT lighted spill/splint and pop REJECT glowing spill/splint IGNORE squeaky pop test alone	1
(iv)	magnesium + hydrochloric acid → magnesium chloride + hydrogen	ACCEPT correct chemical equation	1
(v)	explodes/violent (reaction)	ALLOW dangerous/unsafe ALLOW sodium too reactive/very reactive/reaction too vigorous	1

Question number	Answer	Notes	Marks
9 (b) (i)	Any 2 from **M1** brown/pink/pink-brown solid formed **M2** (blue) solution turns colourless/is decolourised / colour of solution fades/turns paler (blue) M3 zinc metal gets smaller	 ACCEPT brown/pink/pink-brown coating on zinc ALLOW brown/pink/pink-brown precipitate ALLOW red-brown REJECT incorrect initial colour of solution ALLOW zinc dissolves/disappears IGNORE bubbles/effervescence	2
(ii)	M1 don't know whether zinc or nickel is more reactive **M2** because no experiment was done between a zinc salt and nickel/ a nickel salt and zinc OWTTE	 ALLOW no experiment was done to compare zinc and nickel/need to do experiment to compare zinc and nickel OWTTE	2

Question number	Answer	Notes	Marks
9 (c)	**M1** zinc/Zn loses electrons **M2** copper <u>ion</u>/Cu^{2+} gains electrons **M3** zinc/Zn is oxidised and copper/Cu (ion)/Cu^{2+} is reduced	ALLOW correct explanations in terms of oxidation number changes ACCEPT correct half equations for M1 and M2 ALLOW both oxidation and reduction occur (at same time/in same reaction) IGNORE references to loss and gain of oxygen	3

Total for Question 9 = 12

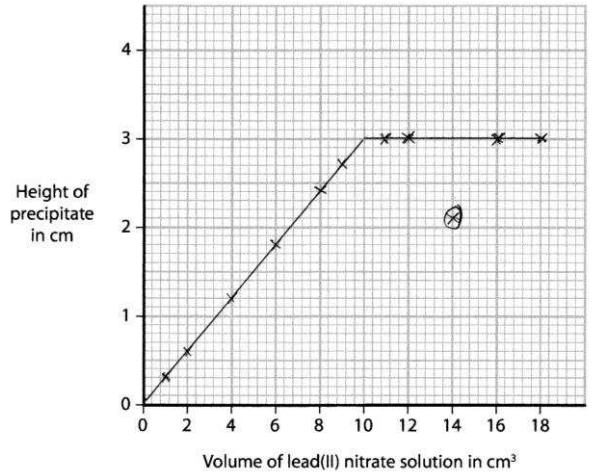
Question number	Answer	Notes	Marks
10 (a) (i)	**M1** in nitrogen/in an element all atoms contain the same number of protons/have the same atomic number **M2** ammonia contains two elements/two different types of atoms/N and H (chemically) bonded together/chemically combined	ALLOW nitrogen / an element contains only one type of atom ALLOW nitrogen only contains nitrogen atoms ACCEPT contains atoms with different numbers of protons/different atomic numbers	2
(ii)	**M1** (X) hydrogen **M2** (raw material) natural gas	ALLOW H_2 IGNORE H ALLOW methane/hydrocarbons/water/steam	2
(iii)	Iron/Fe		1
(iv)	catalyst	ACCEPT references to speed up reaction IGNORE lowers activation energy	1

Question number	Answer	Notes	Marks
10 (b) (i)	neutralisation	ACCEPT acid-base IGNORE exothermic	1
(ii)	**M1** ammonium sulfate **M2** $(NH_4)_2SO_4$	REJECT ammonium sulf**ite**/sulf**ide**	2
(iii)	**M1** add (aqueous) sodium hydroxide/NaOH **M2** test gas/ammonia with (moist/damp) red litmus **M3** (litmus) turns blue	If incorrect or no reagent 0 marks ALLOW other alkalis ACCEPT pH/UI paper ACCEPT indigo/violet/purple if pH paper used If implication that they are testing the solution with litmus no M2 or M3	3

Question number	Answer	Notes	Marks
10 (c)	**M1** liquid occupies smaller volume OWTTE **M2** so can transport larger mass/amount (in same size container) OR M1 gas transported under pressure M2 risk of explosion / leakage	ACCEPT particles in liquid closer together ORA ACCEPT liquid more dense than gas	2
(d) (i)	enthalpy change	ACCEPT heat (energy) change/thermal energy change IGNORE energy change IGNORE enthalpy alone	1
(ii)	(forward) reaction exothermic	ACCEPT backward reaction is endothermic	1
(iii)	more moles (of gas) on right hand side/product side ORA	ACCEPT 9 moles on LHS and 10 moles on RHS ALLOW molecules/particles for moles	1

Question number	Answer	Notes	Marks
10 (e)	**M1** it is a fertiliser/ it contains nitrogen **M2** and therefore increases crop yield / provides essential nutrients for plant growth	ALLOW it provides nitrate ions ALLOW helps crops/plants grow faster/increases plant growth ALLOW for plants to make amino acids/proteins	2

Total for Question 10 = 19

Question number	Answer	Notes	Marks
11 (a) (i)	$Pb(NO_3)_2$ (**aq**) + K_2CrO_4 (**aq**) → $PbCrO_4$ (**s**) + $2KNO_3$ (**aq**)		1
(ii)	$2-/CrO_4^{2-}$	ACCEPT $-2/CrO_4^{-2}$	1
(b) (i)		**M1**& **M2** all eleven points plotted to nearest gridline Deduct 1 mark for each error	2
(ii)	anomalous point (at 2.1, 14) circled		1
(iii)	**M1** best fit straight line through first 6 points drawn with aid of a ruler **M2** best fit straight line through last 5 points drawn with aid of a ruler	No penalty if lines do not cross or if the two straight lines are joined by a curve Penalise lack of use of a ruler once only	2

Question number	Answer	Notes	Marks
11 (b) (iv)	volume from candidate's graph to ± 0.2 cm^3	Do not award mark if lines do not cross.	1
(v)	Any 2 from M1 started with less than 5cm^3 potassium chromate **M2** added too little lead(II) nitrate **M3** precipitate not left for long enough to settle	If no other mark scored allow 1 mark for misread volume/misread height	2
(c) (i)	**M1** filter (off the precipitate) **M2** wash <u>precipitate/solid/lead(II) chromate</u> (with distilled/deionised/pure water) **M3** dry in a (warm) oven / leave to dry / dry with filter paper	ALLOW 'decant' REJEC**T** refs to crystallisation for **M2** and **M3** REJECT any direct method of heating with a flame, eg Bunsen burner	3
(ii)	**M1** flame test **M2** lilac	ACCEPT description of flame test IGNORE burn ALLOW purple/pink	2

Question number	Answer	Notes	Marks
11 (d)	**M1** n[KI] = 5.0 x 0.90/1000 = 0.0045 (mol) **M2** n[$(Pb(NO_3)_2$] = ½ x **M1** = 0.00225 (mol) **M3** conc^n[$Pb(NO_3)_2$] = **M2** x1000/8 = 0.28 (mol/dm^3)	Correct answer without working scores 3 marks ACCEPT any number of sig figs, correctly rounded, except 1 Calculator value is 0.28125 0.56(25) and 1.1(25) both score 2 marks	3

Total for Question 11 = 18

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