Pearson Edexcel

Mark Scheme (Results)

Summer 2019

Pearson Edexcel International GCSE in Chemistry (4CH1) Paper 1CR

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Publications Code 4CH1_1CR_msc_20190822

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 (i)	melting		1
(ii)	evaporation		1
(iii)	sublimation		1
b	A description that refers to three of the following points M1 (particles) close together M2 (particles) regularly arranged M3 (particles) do not move around M4 (particles) vibrate (about a fixed position)	 ALLOW tightly packed/ touching ALLOW arranged in a lattice M1 and M2 can be scored from a diagram ALLOW do not move freely IGNORE references to fixed shape and volume	3 Total 6

Question number	Answer	Notes	Marks
2 a i	potassium reacts more vigorously with water than sodium ✓ potassium sinks to the bottom of the water bubbles of oxygen gas are produced a lilac flame is seen ✓ potassium moves around ✓ potassium oxide solution is formed		3
b (i)	any value or range between 11 and 14		1
(ii)	OH^-	ACCEPT HO^- IGNORE any name	1
c	$4Na + (1)O_2 \rightarrow 2Na_2O$	ACCEPT multiples or fractions	1
			Total 6

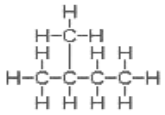
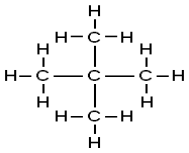
Question number	Answer	Notes	Marks
3 a	A description/diagram which makes reference to the following points M1 put (separate) spots of each of the inks on the (pencil) line. OWTTE M2 pour some solvent into the bottom of the beaker OWTTE M3 place the paper in the beaker so that the spots are (just) above the level of the solvent OWTTE M4 leave until the solvent has risen up the paper (to the top/near the top and then take paper out) OWTTE	ALLOW water for solvent throughout If diagram shows solvent above pencil line only M1 and M2 can be scored DO NOT ALLOW M3 if words and diagram contradict each other ALLOW leave until inks stopped separating OWTTE ALLOW leave until spots/dyes stopped moving OWTTE IGNORE references to leaving for a specified length of time	4

Question number	Answer	Notes	Marks
3 b	An explanation which links the following two points M1 ink would/might dissolve in the solvent OR pencil would not dissolve in the solvent M2 ink would interfere with/contaminate the results OWTTE OR pencil would not interfere with/contaminate the results OWTTE	ALLOW water for solvent ALLOW would produce spots/other colours/get mixed up with inks/move up the paper OWTTE IGNORE smudge/run ALLOW pencil would not produce spots/not produce other colours/not get mixed up with the inks/not move up the paper OWTTE	2

Question number	Answer	Notes	Marks
3 c (i)	For all parts of 3c an explanation which links each of the two points M1 V M2 as it stayed on the start line/did not move	ALLOW blob/dot/mark OWTTE for spot ACCEPT did not produce spots/did not separate ALLOW has R_f value of 0 M2 DEP on M1	2
(ii)	M1 X and Z M2 as they both have a dye/spot that travelled the furthest (up the paper)	ALLOW both have spot closest to solvent front ALLOW have highest R_f value(s) M2 DEP on M1	2
(iii)	M1 V and W M2 as they both only form one spot (on the paper)	ACCEPT as W only has one spot and cannot tell about V (as it does not move/is insoluble) ACCEPT reference to the other inks/X, Y, Z form more than one spot M2 DEP on M1	2

Question number	Answer	Notes	Marks
3 d	• Working or equation for R_f value • Calculating the R_f value • Giving the answer to 2 significant figures		3
	M1 $\frac{4.3}{6.5}$	Award one mark if correct equation for finding R_f value seen	
	M2 0.6615	ACCEPT any number of sig fig	
	M3 0.66	must be 2 sig fig 0.66 with no working scores 3 correct answer given to 3 or more sig fig with no working scores 2 M3 subsumes M2 can score M2 and M3 ECF provided use 4.3 and 6.5 and do a division	
			Total 15

Question number	Answer	Notes	Marks
4 a	M1 (a compound containing the elements/atoms) hydrogen and carbon	ALLOW molecule/substance for compound REJECT element/atom/ mixture for compound REJECT ions/molecules for elements/atoms	2
	M2 only	ACCEPT other equivalent words eg solely M2 DEP on mention of hydrogen and carbon in M1	
b (i)	$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$ M1 all formulae correct M2 balancing of correct formulae	ALLOW fractions/multiples IGNORE state symbols	2
(ii)	Any two from M1 carbon monoxide M2 carbon M3 water	ACCEPT correct formulae/symbol ALLOW soot for carbon	2
(iii)	reduces/limits capacity of blood to transport oxygen OWTTE	ACCEPT prevents blood from carrying oxygen OWTTE ACCEPT correct references to haemoglobin eg prevents haemoglobin from carrying oxygen	1
	M1		2

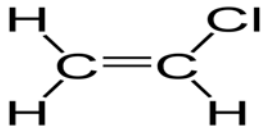
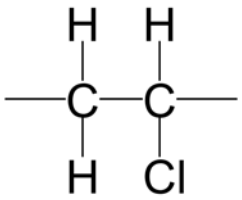
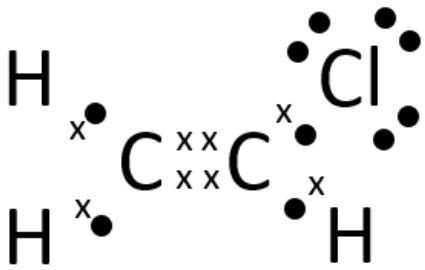
b(iv)			
	M2 	in either order	
c (i)	C_nH_{2n}		1
(ii)	(contains a carbon to carbon) double bond	ALLOW (contains a carbon to carbon) multiple bond	1
(iii)	A description linking the following two points M1 add bromine water/solution M2 (bromine water/solution) is decolourised / turns (from orange to) colourless	 ALLOW $Br_2(aq)$ IGNORE clear REJECT discoloured If initial colour of bromine water given it must be correct- ALLOW any combination of orange/yellow/brown M2 dep on M1 or near miss ALLOW M1 add acidified potassium manganate(VII) M2 (potassium manganate(VII)) is decolourised/turns (from purple to) colourless REJECT any other initial colour	2 Total 13

Question number	Answer	Notes	Marks
5 a (i)	An explanation linking the following two points M1 to stop acid (spray) leaving the flask OWTTE	ALLOW so that only gas can escape (from flask) OWTTE ALLOW so the only cause of mass loss is gas (escaping) REJECT stops gas escaping REJECT references to substances/impurities/gases entering flask	2
	M2 as (without cotton wool) mass loss would be too large OWTTE	ALLOW as with cotton wool the mass does not decrease by more than it should OWTTE	
a (ii)	B gas is given off A is incorrect as particles moving does not result in mass loss C is incorrect as heat energy being produced does not result in mass loss D is incorrect as marble chips dissolving does not result in mass loss		1
b	$CaCO_3$ (s) + 2HCl (aq) $\rightarrow$ $CaCl_2$ (aq) + H_2O (l) + CO_2 (g) All 5 correct scores 2 4, 3 correct scores 1	ALLOW upper case	2

Question number		Answer	Notes	Marks
5	c	M1 curve steeper than the original curve M2 levels off at the same mass loss/place as original curve		2
	d (i)	An explanation linking the following three points M1 (rate) increases M2 more particles in the same volume M3 more (successful) collisions per unit time / more frequent (successful) collisions	ALLOW particles closer together If reference to particles move faster/have more energy MAX 1 IGNORE references to increased chance/probability of collisions	3
	(ii)	An explanation linking the following three points M1 (rate) increases M2 (mean kinetic) energy of particles increases M3 more successful collisions per unit time / more frequent successful collisions OWTTE	ALLOW particles move faster ALLOW more particles have energy ≥ activation energy ALLOW reference to more frequent collisions between particles having ≥ activation energy	3
				Total 13

Question number	Answer	Notes	Marks
6 (a)	• Dividing percentages by atomic masses • Correct results of divisions • Obtaining ratio by dividing results by smallest value M1 C H Cl $\frac{38.4}{12}$ $\frac{4.8}{1}$ $\frac{56.8}{35.5}$ M2 3.2 4.8 1.6 M3 $\frac{3.2}{1.6}$ $\frac{4.8}{1.6}$ $\frac{1.6}{1.6}$ (= 2 3 1) Alternative method • Calculating Mr of C_2H_3Cl • Working for finding ratio of each element • Evaluation of correct percentages M1 C_2H_3Cl (= 24 + 3 + 35.5) = 62.5 M2 C H Cl $\frac{24}{62.5}$ $\frac{3}{62.5}$ $\frac{35.5}{62.5}$ M3 all x 100 = 38.4(%) 4.8(%) 56.8(%)	0 marks if division by atomic numbers or calculation upside down	3

Question Number	Answer	Notes	Marks
(b) (i)	$FeCl_3$	REJECT incorrect use of upper and lower case letters, and superscript ACCEPT correct formula as ions $Fe^{3+}(Cl^-)_3$	1
(ii)	to increase the rate of the reaction/ to speed up the reaction	ALLOW references to (providing reaction pathway of) lower activation energy	1
(iii)	gives out heat (energy)	ACCEPT thermal energy NOT energy alone IGNORE reference to negative $\triangle H$	1
(iv)	A addition B is incorrect as this is not a displacement reaction C is incorrect as this is not a neutralisation reaction D is incorrect as this is not a substitution reaction		1
(v)	$C_2H_4Cl_2 \rightarrow C_2H_3Cl + HCl$	IGNORE incorrect use of lower/upper case and superscripts	1

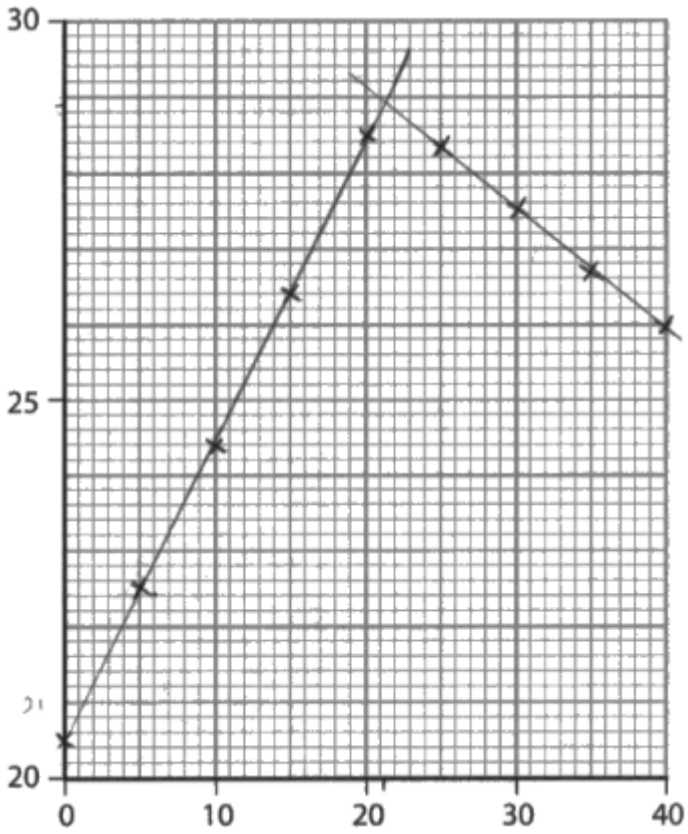
Question number	Answer	Notes	Marks
6 (c) (i)	M1 displayed formula of chloroethene 	IGNORE bond angles IGNORE brackets/n	3
	M2 correct displayed formula with single bond between C atoms 	If double bond in repeat unit no M2 or M3 IGNORE brackets/n	
	M3 extension bonds shown on C atoms	more than one correct repeat unit with extension bonds scores 1 mark out of M2/M3	
(ii)	M1 2 shared pairs between C atoms M2 rest of structure fully correct 	ACCEPT any combination of dots and crosses. IGNORE inner shells even if incorrect M2 DEP on M1	2
			Total 13

Question number	Answer	Notes	Marks
7 a (i)	M1 Mg^{2+} M2 NO_3^-		2
7 a (ii)	Part 1 making magnesium nitrate solution - a description linking any three of the following points M1 warm / heat the acid (in a beaker/flask) M2 add magnesium oxide (to acid a little at a time) until in excess /no more dissolves M3 stir M4 filter to remove excess magnesium oxide/excess solid	REJECT boil M3 DEP on use of acid and oxide	6

	Part 2 using (magnesium nitrate) solution/filtrate - a description linking any three of the following points M5 heat/boil (magnesium nitrate solution/filtrate) M6 until crystals form in a cooled sample/on glass rod M7 leave the solution to cool/crystallise M8 filter (to remove crystals) M9 suitable method to dry the crystals eg using filter paper/using paper towel/in warm oven/in a desiccator	NOTE if added excess but not filtered off – MAX 2 for Part 2 ACCEPT to crystallisation point / to form a saturated solution / until crystals start to form / to remove some of the water M6 DEP M5 ACCEPT decant the (excess) solution IGNORE references to washing the crystals REJECT hot oven or any method of direct heating e.g. Bunsen ALLOW leave to dry but not just dry the crystals M9 DEP M8 No M9 if then wash crystals after drying	

7 (b) (i)	24 + (2 x 14) + (6 x 16) + (12 x 1) + (6 x 16) or equivalent working	Some working must be seen ALLOW 24 + 124 +108	1
(ii)	• Calculate moles of magnesium nitrate • Setting out of calculation of mass • Final answer M1 moles = (0.05 / 2) OR 0.025 M2 mass = 0.025 x 256 M3 6.4 (g)	6.4(g) with no working scores 3 only ALLOW ECF M2 from M1	3
(iii)	• Setting out of calculation • Final answer M1 $\frac{4.8}{6.4}$ x 100 M2 75 (%) OR M1 $\frac{4.8}{6}$ x 100 M2 80 (%)	75 (%) with or without working scores 2 marks 80 (%) with or without working scores 2 marks ALLOW ECF from b(ii) $\frac{6.4}{4.8}$ x 100 AND $\frac{6}{4.8}$ x 100 both score 0 Answers of 25% and 20% score 1	2 Total 14

Question number	Answer	Notes	Marks
8 (a) (i)	sodium hydroxide + nitric acid → sodium nitrate+ water	ACCEPT correct chemical equation IGNORE ionic equation	1
(ii)	An explanation which links the following two points M1 polystyrene is an insulator	 ALLOW poor/non-conductor of heat	2
	M2 less heat is lost (to the surroundings)	ALLOW no heat lost ALLOW (polystyrene) retains more heat ALLOW reverse arguments for glass beaker	
(iii)	Any one from (she should) wear eye protection (she should) wear gloves	 ACCEPT (safety) goggles ALLOW safety glasses	1

(b) (i) clip	M1 all points plotted correctly to +/− half a square M2 first best fit line drawn with a ruler M3 second best fit line drawn with a ruler  	Award MAX 1 if ruler not used for both DO NOT PENALISE HERE IF LINES DO NOT CROSS	3
(ii)	M1 volume reading read from graph +/- 0.5 (cm^3) M2 temp reading read from graph to +/- 0.1 (°C)	Award 1 mark if values correct but reversed. If lines do not meet or cross or a curve is drawn between the lines 0 marks for (ii)	2 Total 9

Question number	Answer	Notes	Marks
9 (a)	An explanation linking the following three points M1 covalent bonds are strong M2 many (covalent) bonds (need to be broken) M3 a large amount of (thermal/heat) energy is needed to break the bonds	ACCEPT strong (electrostatic) forces of attraction between the nuclei of atoms and the bonding electrons IGNORE more energy NOT just heat Any mention of intermolecular forces/forces between molecules or ions/ionic bonding /metallic bonding scores 0 out of 3	3

(b)	(i)	An explanation linking the following two points M1 the intermolecular forces (of attraction) are weak M2 therefore little/less (thermal/heat) energy needed to overcome the forces (of attraction)	 ACCEPT London forces/dispersion forces/dipole-dipole forces/Van der Waals forces ALLOW the attractions between the molecules are weak ALLOW weak intermolecular bonds NOT just heat ALLOW little/less energy needed to separate the (fullerene) molecules ALLOW little/less energy is required to break the bonds as long as it is clear that the bonds are between molecules Any mention of (breaking of) covalent/ionic/metallic bonds scores 0 out of 2	2
	(ii)	Any one from the medicine can fit inside (the C_{60} molecule/it) (the C_{60} molecule/it) will not react with the blood/medicine (the C_{60} molecule/it) is non-toxic	 ALLOW any other sensible suggestion eg C_{60} molecule/it is inert/unreactive	1

(c)	An explanation linking any five of the following six points but must include M3 and M6 for full marks (graphite is soft because) M1 the structure is in layers M2 there are weak forces/attractions between the layers (of atoms) M3 layers can slide/slip over each other (graphite conducts electricity because) M4 each carbon atom is (covalently) bonded to three other carbon atoms M5 one delocalised electron per carbon atom M6 delocalised electrons flow/move (through the structure)	If reference to weak intermolecular forces or layers of molecules/ions no M2 ALLOW air /water (molecules) trapped between the layers ALLOW layers can easily flake off M2/ M3 can subsume M1 ALLOW one unbonded/free/spare electron per carbon atom ALLOW (only) three (of the carbon) electrons involved in (covalent) bonding ALLOW not all (of the carbon) electrons involved in (covalent) bonding ALLOW are mobile IGNORE free electrons IGNORE sea of electrons IGNORE references to carrying charge/current To score M6 the term delocalised electrons must be seen somewhere If reference to ions for conduction of electricity no M4 M5 M6	5 Total 11

Question number	Answer	Notes	Marks
10 (a) (i)	(because) the zinc (powder) is in excess	ALLOW (because) not all zinc is used up/reacts ALLOW (because) some zinc is left over ALLOW because copper sulfate is limiting reagent/all reacted/all used up	1
(ii)	M1 blue	ALLOW qualifiers such as dark/light but no other colours	2
	M2 to colourless	IGNORE clear ALLOW no colour ALLOW decolourised REJECT discoloured	
(b) (i)	• Calculation of temperature increase • Substitution into Q = $mc\Delta T$ • Evaluation Example calculation M1 (31.5 – 19.0) OR 12.5 M2 Q = 25 x 4.18 x 12.5 M3 Q = 1310 (J)	 25 x 4.18 x (31.5 – 19.0) scores M1 and M2 Calculator answer is 1306.25 ACCEPT any number of sig fig greater than 1 Correct answer to 3 or more sig fig without working scores 3 1300 with no working scores 0 If answer in kJ unit must be given ALLOW use of 4.2 for all 3 marks (= 1312.5)	3

(ii)	$n(CuSO_4) = (2.00 \div 159.5) = 0.0125$	ACCEPT any number of sig figs except 1	1
(iii)	• Division of *Q* by *n* • Evaluation including conversion of J to kJ • Answer given with - sign Example calculation M1 $\frac{Q}{n}$ OR $\frac{1300}{0.0125}$ OR answer to b(i) / answer to b(ii) M2 ΔH = (–) 104 (kJ/mol) M3 Negative sign included	ACCEPT any number of sig figs in the numerator except 1 ACCEPT any number of sig figs ALLOW ECF from M1 Correct answer with no working and no sign or incorrect sign scores 2 Correct answer with no working and correct sign scores 3 104.5(04) 104.48 104.8 105 all score 2 -104.5(04) -104.48 -104.8 -105 all score 3	3 **Total 10**

Total marks 110

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