Mark Scheme (Results)

Summer 2015

Pearson Edexcel International GCSE Chemistry (4CH0) Paper 1C
Science Double Award (4SC0) Paper 1C

Pearson Edexcel Level 1/Level 2 Certificate Chemistry (KCH0) Paper 1C
Science (Double Award) (KSC0) Paper 1C

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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.

Question number	Answer	Notes	Marks
1 a i	six circles separated from each other	Accept minimum of 4 complete circles Ignore size and shape of circles Ignore arrows and other symbols implying movement Ignore a pattern Reject any touching circles Reject circles joined by bonds No penalty for half-circles at edges of square	1
ii	B (They move randomly in the liquid state)		1
iii	D (melting)		1
b i	B (condensing and evaporating)		1
ii	D ($N_2(l)$)		1
			Total 5 marks

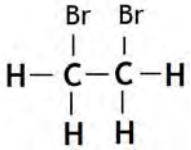
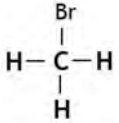
Question number	Answer	Notes	Marks
2 a	M1 C (Bromine has a darker colour than air) M2 D (Bromine vapour diffuses upwards)		2
b i	C		1
ii	M1 ammonia (particles/molecules) travels/diffuses faster / further in same time (than hydrogen chloride) M2 (because of) lower M_r	Do not penalise ammonia atoms / ammonium (ions) / ammonia solution in place of ammonia If incorrect choice in (i), then no marks in (ii) If no answer in (i), mark on If C appears in (ii), mark can be awarded in (i) Accept smaller/lighter / ammonia less dense Reject ammonia molecules etc less dense Ignore references to kinetic energy Accept reverse argument for hydrogen chloride / hydrochloric acid for both M1 and M2	2
			Total 5 marks

Question number	Answer	Notes	Marks
3 a	M1 bright / white / blinding AND flame / light (OWTTE) M2 white solid	Accept answers in either order Ignore shines / glows / sparks Accept burns brightly Reject other colours Accept smoke / powder / ash / deposit in place of solid Reject precipitate in place of solid Ignore grey Ignore name of product and equation Ignore references to decrease in amount of magnesium / heat given off	2
b	C (a basic oxide formed from a metal)		1
c i	blue	Ignore shades Ignore purple Reject all other colours Mark (i) and (ii) independently	1
ii	hydroxide (ion) / OH^- / HO^-	Ignore OH	1
			Total 5 marks

Question number	Answer	Notes	Marks
4 a	$CaCl_2$(**aq**) + H_2SO_4(**aq**) → $CaSO_4$(**s**) + 2HCl(**aq**)	All four must be correct to score Do not penalise upper case letters	1
b		M1 filter paper in filter funnel Do not penalise inappropriate size M2 everything else correct Not essential that funnel touches flask Reject beaker/tube for M2 Ignore labels Ignore relative sizes	2
c i	Ca^{2+} / calcium (ion)	Reject Ca with incorrect or missing charge Mark (i) and (ii) independently	1
ii	calcium sulfate/$CaSO_4$ partially/slightly soluble OR contains unreacted/excess calcium chloride/$CaCl_2$ (solution)	Accept <u>unreacted/excess</u> calcium ions	1

Question number	Answer	Notes	Marks
4 d i	white precipitate	Accept solid / ppt / ppte / suspension in place of precipitate Reject other colours Reject other observations eg fizzing Ignore cloudy/milky/grey	1
ii	silver chloride	Accept correct formula Ignore incorrect formula Award both marks if both answers in either (i) or (ii)	1
iii	(hydrochloric/sulfuric) acid / H^+ there OR solution acidic	Accept because there are no other ions that could form a precipitate Accept no carbonate/hydroxide (ions)	1
e	M1 wash/rinse (with water) M2 leave it (to dry) / leave in a warm place / place in an oven / place in desiccator / heat it / dry with absorbent paper (eg kitchen/filter/blotting)	Reject methods that refer to filtrate /solution /crystallisation Ignore other named solvents Accept leave on a window ledge Ignore evaporate it / boil it Award 1 mark for both M1 and M2 correct but in wrong order	2
			Total 10 marks

Question number	Answer	Notes	Marks
5 a i	C_5H_{12}	Accept $H_{12}C_5$ Ignore gap between C_5 and H_{12} Ignore names Ignore C_nH_{2n+2}	1
ii	CH_2Br	Accept elements in any order Ignore molecular formula Ignore $2CH_2Br$ Penalise inappropriate use of upper or lower case letters or numbers(eg CH2Br / CH_2BR / CH^2Br)	1
b i	R <u>and</u> U	Accept in either order	1
ii	D (C_nH_{2n})		1
c	C (compound R → compound Q)		1

Question number	Answer	Notes	Marks
5 d	M1  M2 (1,2-)dibromoethane	Mark M1 and M2 independently Accept Br atoms in any positions so long as on different carbon atoms Ignore any numbers Accept ethylene dibromide	2
e i		Ignore balancing in equation Ignore molecular formula	1
ii	bromomethane		1
iii	UV or ultraviolet (light/radiation)	Accept sunlight Ignore all references to heat and temperature Ignore references to pressure	1
iv	D (substitution)		1

Question number	Answer	Notes	Marks
5 f i	M1 setting out division of each % by A_r OR evaluation C H F 36.4 6.0 57.6 12 1 19 OR 3 6 3 M2 simplest whole number ratio (1:2:1 or ratio shown in notes for M1.) M3 CH_2F	Award 0/3 if division by any atomic numbers / wrong way up / multiplication used Do not penalise roundings or minor misreads of % values (eg 56.7 for fluorine) Do not penalise use of Fl in (i) If molecular masses used for H and/or F, lose M1 but M2 and M3 can be awarded: using 2 and 38 gives C_2H_2F using 2 and 19 gives CHF Using 1 and 38 gives C_2H_4F Working required for these answers M2 subsumes M1 Accept elements in any order Award 3 marks for correct final answer with no working	3
ii	$C_2H_4F_2$	Accept elements in any order Do not accept $C_2H_4Fl_2$	1
			Total 15 marks

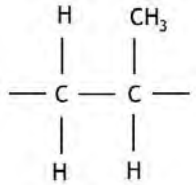
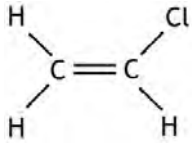
Question number	Answer	Notes	Marks
6 a	(A) refinery gases (F) bitumen		2
b	M1 (compound/molecule/substance containing) carbon and hydrogen/C and H (atoms/elements) M2 only	Reject atom/element/ion/mixture in place of compound/molecule/substance Reject compound/molecule/substance in place of atom/element Ignore references to bonds / long chains Accept other terms with same meaning, eg solely / exclusively / just M2 DEP on mention of carbon and hydrogen/C and H and no other element	2

Question number	Answer	Notes	Marks
6 c	(fuel oil molecules/it/they) M1 have higher boiling points M2 are darker (in colour) M3 have higher viscosities / are more viscous	Accept converse statements about gasoline Ignore reference to melting points Ignore stronger / more intense (colours) If specific colours stated, award M2 if valid comparison, eg gasoline is yellow and fuel oil is brown, fuel oil is browner Accept thicker/stickier/flows less easily, etc in place of more viscous If gasoline, accept thinner/runnier/flows more easily, etc in place of less viscous Must be a comparison, eg not enough to say fuel oil has a high boiling point unless also a statement that gasoline has a low boiling point MAX 2 if no comparison Accept reference to fractions near the top/up the column in place of gasoline Accept reference to fractions near the bottom/down the column in place of fuel oil	3

d	i	silica / silicon dioxide / SiO_2 OR alumina / aluminium oxide / Al_2O_3	Accept aluminosilicate(s) / zeolites Ignore silica oxide and alumina oxide	1
	ii	M1 C_2H_4 M2 C_3H_6	Accept in either order Award 1 mark for C_4H_8 <u>and</u> CH_2	2

Question number	Answer	Notes	Marks
6 e i	insufficient/lack of air / oxygen OWTTE	Accept oxygen not in excess Reject no oxygen	1
ii	carbon monoxide / CO		1
iii	decreases capacity of blood (cells) to carry oxygen OR stops blood (cells) from carrying oxygen	Accept CO combines with haemoglobin / forms carboxyhaemoglobin Accept CO displaces/replaces oxygen in haemoglobin Ignore CO combines with red blood cells Ignore references to suffocation / lack of oxygen in lungs stopping breathing / gas exchange Ignore just affects haemoglobin Reject destroys haemoglobin Mark all parts independently	1

Question number	Answer	Notes	Marks
6 f i	M1 sulfur dioxide AND sulfur trioxide in correct order	Accept names with correct oxidation states	2
	M2 sulfuric acid	Ignore dilute / concentrated Ignore hydrogen sulfate / hydrogensulfate	
ii	M1 acid rain	Accept makes lakes acidic / lowers pH of lakes	2
	M2 specific adverse effect on specific object	**plants** plants/trees/vegetation/crops/named example eg dies/stunted growth/harmed/damaged/poisoned Ignore deforestation Ignore leaching minerals **fish** fish/aquatic animals/pond life/marine life/named example eg dies/stunted growth/harmed/damaged/poisoned Ignore references to just animals Accept **limestone** 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	
			Total 17 marks

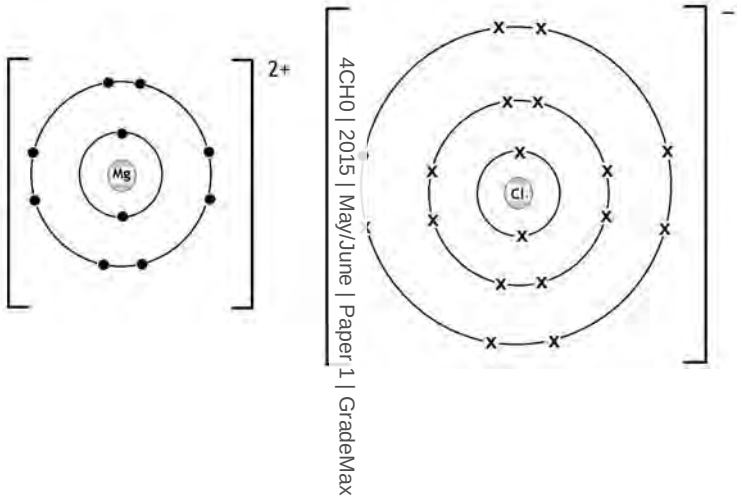
Question number	Answer	Notes	Marks
7 a	A (addition)		1
b	A (a molecule used to make a polymer)		1
c i	propene		1
ii		M1 chain of two carbons joined by single bond AND both continuation bonds M2 one CH_3 group in any position AND three H atoms Do not penalise bond to H of CH_3 Reject any structure with double bond Allow multiple repeat units if correct Three or more CH_2 groups linked together scores 0/2 Ignore brackets and subscripted n	2
d		Accept Cl in any position Ignore bond angles Ignore brackets / n	1

Question number	Answer	Notes	Marks
7 e i	M1 (polymer) breaks down / decomposes / decays	Do not penalise compound / object / molecule / substance in place of polymer Reject element in place of polymer Ignore rots / degrades / digests / disintegrates If reference to <u>not</u> breaking down etc, only M2 can be awarded	2
	M2 by bacteria / microbes / microorganisms / decomposers /enzymes	Accept biologically / naturally M2 DEP on M1 or near miss	
ii	inert(ness) / unreactive / OWTTE	Ignore do not react with named chemical Ignore references to bond strengths / bond breaking	1
			Total 9 marks

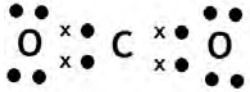
Question number	Answer	Notes	Marks
8 a	pipette		1
b	B (pink to colourless)		1
c	correct reference to one of these: • number of colours • end point/colour change (accept neutral point)	Examples: phenolphthalein has <u>only</u> two colours / only one colour change / negative statement eg does not have a range of colours / UI has several colours/more than one colour change sharp / definite / sudden / quick / not gradual / needs only one drop / converse for UI	1
d	M1 (after) 24.15 (only this answer) M2 (before) 2.30 (only this answer) M3 (added) 21.85	Award 1 mark for both burette readings correct but in wrong order CQ on after and before readings In M3, penalise answer not to 2 dp unless penalty already applied in M2	3

Question number	Answer	Notes	Marks
8 e i	ticks in columns 2 and 4		1
ii	M1 $\frac{26.30 + 26.40}{2}$	CQ on ticked results If no results ticked, award M1 only if columns 2 and 4 averaged If only one result ticked, no marks can be awarded in (e)	2
	M2 26.35	CQ on results averaged Answer must be to 2 dp M2 subsumes M1	

f		In part (f): • accept values in standard form, eg 4.5×10^{-3} • do not accept unevaluated fractions, eg 0.0045÷3 in (ii) • do not penalise too many sig figs • correct answer without working scores 2 marks in (i) and (iii) • penalise missing use of 1000 in (i) and (iii) once only	
i	M1 $\frac{0.18(0) \times 25(.0)}{1000}$		2
	M2 0.0045(0)	Award 1 mark for 4.5	
ii	(0.0045 ÷ 3 =) 0.0015(0)	CQ on answer to (i)	1
iii	M1 $\frac{0.0015 \times 1000}{28.3(0)}$	CQ on answer to (ii)	2
	M2 0.053(0)	Award 1 mark out of 2 for 0.000053 Award 1 mark out of 2 for 0.05 If correct final answer obtained by omission of 1000 in both (i) and (iii), award marks of 1,1, 2	
			Total 14 marks

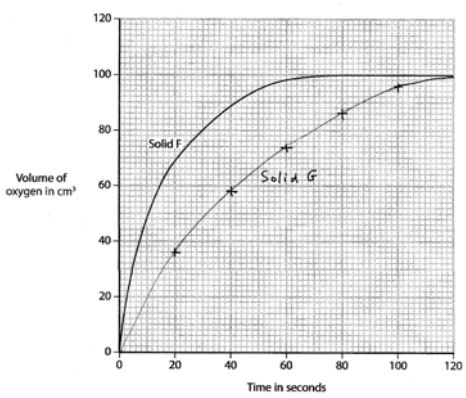
Question number	Answer	Notes	Marks
9 a	A simple molecular B giant covalent C giant metallic D giant ionic		4
b i	M1 electron transfer AND correct direction M2 magnesium (atoms) lose 2 electrons M3 (each) chlorine (atom) gains an electron	If any reference to sharing electrons, 0/3 If any reference to covalent bonds, MAX 2 Penalise atoms in place of electrons each time Accept two chlorine (atoms) gain two electrons Reject chloride in place of chlorine M2 and M3 both correct also scores M1	3
ii		M1 for electronic configuration of Mg^{2+} ion M2 for electronic configuration of Cl^- ion M3 for both charges correct Accept any combination of dots and crosses Charges can be shown anywhere so long as there is no ambiguity Brackets not essential Ignore 2 before or after chloride ion 0/3 for any diagram showing shared electrons Ignore diagrams showing electron transfer – mark only the ions formed Penalise missing inner shell(s) once only If two Cl^- ions shown, both must be correct	3

Do not penalise empty third shell in Mg^{2+}
If only 2.8 etc notations without diagram, only M3 can be awarded

Question number	Answer	Notes	Marks
9 c		M1 for 4 electrons in both C=O bonds These can be shown in a vertical or horizontal line M2 all other electrons correct M2 DEP on M1 Accept any combination of dots and crosses Ignore inner electrons even if wrong Ignore circles around atoms Non-bonding electrons do not need to be paired	2
d i	M1 positive ions / cations M2 delocalised electrons / sea of electrons M3 crystal / lattice / regular arrangement / array / giant structure OWTTE	Not just ions Reject reference to protons/nuclei/atoms in place of cations for M1, but M2 and M3 can still be awarded Ignore free electrons Ignore layers / planes / rows or similar Accept (electrostatic) attraction between positive ions and electrons 0/3 if reference to ionic bonding / covalent bonding / molecules / intermolecular forces (eg van der Waals')	3

Question number	Answer	Notes	Marks
9 d ii	M1 layers / sheets / planes / rows AND (positive) ions / atoms / particles M2 slide (over each other)	 Allow OWTTE, eg slip / flow / shift / roll / move M2 DEP on mention of EITHER layers or equivalent OR mention of ions or equivalent Do not award M2 if protons / electrons / nuclei / molecules in place of ions, etc If reference to ionic bonding / covalent bonding / molecules / intermolecular forces, no marks	2
			Total 17 marks

Question number	Answer	Notes	Marks
10 a	M1 volume M2 concentration	Ignore amount of solution for both, but accept amount in cm^3 for M1 Reject volume of gases Allow mass of solution Ignore strength Ignore temperature / pressure Accept in either order	2
b i	B		1
ii	D		1
c	M1 filter (and dry) and weigh solid/A/it M2 mass is (still) 1g / mass is unchanged	Mark M1 and M2 independently Accept separate/remove solid/A/it from reaction mixture and weigh it Accept reverse argument, eg if it was a reactant, the mass would decrease	2

Question number	Answer	Notes	Marks
10 d i		M1 + M2 all five points plotted to nearest gridline Points at zero and 120 are not essential but must be correct if plotted Deduct 1 mark for each error up to max 2 M3 curve of best fit Curve does not need to be labelled If curve correct but points not visible under curve, award M1 and M2 Curve CQ on points plotted Penalise repeated straight line(s) joining points / more than one curve visible	3
ii	M1 some indication on graph M2 volume CQ on candidate curve	eg vertical line up from 70s OR horizontal line to where line from 70s would meet curve OR cross on graph Must be an integer (cm^3) No marks if original curve used	2
iii	curve steeper /gradient steeper/greater OR curve levels off earlier / curve reaches $100cm^3$ in shorter time / OWTTE	Accept line for curve Accept graph is steeper Accept answers that do not depend on graph but can be obtained from the table of results, eg bigger volume in a shorter time, reaction stopped earlier	1
			Total 12 marks

Question number	Answer	Notes	Marks
11 a i	(pressure) low		1
ii	fewer (gas) moles/molecules/particles on left OR fewer moles/molecules/particles of reactants OR forward reaction produces more moles/molecules/particles	Accept statement about numbers of moles / molecules, eg 3 on left and 5 on right Accept more (gas) moles/molecules/particles on right / more moles/molecules of products but not just more products Ignore references to favouring right hand side/forward direction /endothermic reaction /equilibrium shifting to right /Le Chatelier's principle /low pressure favours side with more moles Ignore references to rate / collisions If answer to (i) is high, no ECF in (ii) If no answer to (i), mark can be awarded in (ii)	1
b i	(temperature) high		1
ii	(forward) reaction is endothermic / has positive Δ*H* value / absorbs heat	Accept reverse reaction is exothermic / has negative Δ*H* value / gives out heat Ignore favours the endothermic reaction Ignore references to rate / collisions If answer to (i) is low, no ECF in (ii) If no answer to (i), mark can be awarded	1

c	Δ*H* (value)/enthalpy change is small / smaller / less (than for reactions 1 and 3) OR reaction not very exothermic / has lowest enthalpy change	Accept energy in place of enthalpy Accept closer to zero Reject Δ*H* less negative / less exothermic / less heat given out Ignore references to temperature change / pressure Ignore less energy / not a lot of energy needed	1

Question number	Answer	Notes	Marks
11 d		Ignore references to yield / equilibrium / chances of collision in (i) and (ii)	
i	(rate) increases		1
ii		Mark M1 and M2 independently	2
	M1 particles closer together	Accept more particles in a given volume/space /particles have less space/room (to move in) Ignore area in place of volume/space Ignore references to just numbers of gas moles/molecules	
	M2 particles collide more frequently	Not just more (successful) collisions Accept more (successful) collisions per unit time / per second, etc	
		0/2 if references to particles moving faster/having greater energy	
		If answer to (i) is decreases, no ECF in (ii) If no answer or ignored answer to (i), marks can be awarded	

Question number	Answer	Notes	Marks
11 e	Accept working by mass ratio OR moles routes Mass ratios: M1 M_r (CH_3OH) = 32 AND M_r (CH_3COOH) = 60 M2 m(CH_3COOH) = $\frac{64 \times 60}{32}$ M3 120 (kg) OR Moles: M1 n(CH_3OH) = 64 000 ÷ 32 = 2000 (mol) M2 n(CH_3COOH) = 2000 (mol) M3 m(CH_3COOH) = 2000 × 60 = 120 000 g / 120 (kg)	Award M1 for 32 and 60 seen anywhere, except as the result of incorrect calculations Mark M2 and M3 consequentially on M_r values Allow working in 'kilomoles' even if mol given as unit or no unit for intermediate answers, eg 64 ÷ 32 = 2 (kmol/mol) CQ on M1 CQ on M2 Correct final answer with or without working scores 3 marks Accept 120 000 g if unit shown	3
			Total 11 marks