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Mark Scheme (Results)

January 2013

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

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

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Question number				Answer	Notes	Marks
1	a		M1	nucleus		1
			M2	protons	Accept in either order	1
			M3	neutrons		1
			M4	electrons		1
			M5	shells		1
			M6	protons AND electrons	In either order	1
			M7	electrons		1
	b	i		3		1
		ii		5		1
2	a	i		C		1
		ii		B		1
	b			fluorine / F_2	Accept F	1
	c	i		hydrogen chloride		1
		ii		hydrochloric (acid)		1
		iii		HCl		1
					Total	**15**

Question number				Answer	Notes	Marks
3	a	i	M1	bubbles / fizzing / effervescence	Accept gas formed /given off	1
					Ignore any name or formula	
			M2	iron/solid disappears OR green/colourless solution (forms)	Accept iron/solid gets smaller / dissolves	1
					Ignore references to heat change / change in pH	
		ii		iron sulfate AND hydrogen (in either order)	Penalise oxidation states other than (II)	1
					Accept ferrous sulfate	
					Reject ferric sulfate	
	b			2 (1) 2	Accept multiples and fractions	1
	c	i	M1 M2	white blue	Ignore colourless Ignore all qualifiers such as pale / dark	1 1
		ii		D		1
		iii	M1 M2	boiling point / melting/freezing point 100 ºC / 0 ºC	 Accept just º or C but not just number Value must match property Accept correct values in K Ignore other physical properties such as pH / density	1 1

Question number				Answer	Notes	Marks
3	d	i		low density / less dense than air	Accept lighter than air / the lightest gas but not just light / lightweight	1
		ii		non-flammable OR does not burn / explode (when ignited)	Ignore unreactive Accept does not react with oxygen/air	1
	e			$H_2(g) \rightarrow H_2(l)$	Ignore "+ heat/energy" on RHS Penalise indication of endothermic process	1
					Total	**12**

Question number				Answer	Notes	Marks
4	a	i		oxygen / air	Accept O_2 but not just O	1
		ii		iron(III) oxide / ferric oxide	Ignore hydrated Accept iron oxide but not ferrous oxide or iron oxide with an incorrect oxidation state	1
	b	i		nail is wet / needs drying OR rust absorbs water/is wet / rust falls off	 Not just some of the nail/it falls off	1
		ii		bigger/biggest increase/change in mass OR mass of rust greater/greatest	Accept mass increased more Ignore highest mass Ignore just mass increased by 0.3 g Accept weight in place of mass	1
		iii		bigger/biggest increase/change in mass with correct reference to proportion or percentage		1
		iv		mass has decreased	Accept mass has not increased / should have increased Accept mass cannot decrease Accept nail got lighter	1
	c		M1	grease / oil		1
			M2	paint		1

Question number				Answer	Notes	Marks
4	d		M1	galvanising / sacrificial (protection)	Ignore references to anode / cathode	1
			M2	zinc more reactive (than iron) OR iron less reactive (than zinc)	Accept zinc higher in (re)activity series OR iron lower in (re)activity series Must be comparison, eg not just zinc is reactive without statement that iron is unreactive	1
			M3	zinc reacts/corrodes/oxidises instead of iron OR zinc reacts/corrodes/oxidises before iron	Accept zinc reacts faster than iron Accept zinc loses electrons instead of/before iron / zinc gives electron(s) to iron (ions) Reject zinc rusts Reject protective layer of zinc oxide Ignore erodes	1
					Total	**11**

Question number				Answer	Notes	Marks
5	a		M1	(compound/molecule/substance containing) carbon and hydrogen (atoms)	Reject atoms/elements in place of compounds Reject molecules in place of atoms Reject mixture Accept C and H in place of carbon and hydrogen	1
			M2	only	M2 dependent on M1 or near miss, eg mixture of C and H Accept equivalent wording such as alone / purely / solely	1
	b			contains (C=C) double bonds	Accept multiple bonds Reject implied C=H	1

Question number				Answer	Notes	Marks
5	c	i		alkene(s)		1
		ii		C_nH_{2n}	Accept other symbols such as x Accept $H_{2n}C_n$	1
		iii	M1	same/similar chemical properties	Accept same/similar reactions Do not accept a specific reaction, eg they all burn Ignore similar reactivities	2
			M2	trend/gradation in physical properties	Accept named trend eg boiling point Accept correct trend eg smaller molecules have lower boiling points, but not incorrect trend such as smaller molecules have higher boiling points	
			M3	same functional group		
			M4	(neighbouring) members differ by CH_2		
					Any two for 1 each	

Question number				Answer	Notes	Marks
5	d	i		but-1-ene	Accept butene Ignore mention of cis or trans	1
		ii		C_4H_8		1
		iii	M1	(compounds/molecules with) same molecular formula / same number of each type of atom	Do not penalise specific compound types, eg hydrocarbons / alkenes If elements/atoms in place of compounds, max 1 for Q Ignore references to chemical/general/empirical formula	1
			M2	different structure(s) / different structural formula(e) / different displayed formula(e)	Ignore atoms in a different order	1
		iv		displayed formula of but-2-ene or methylpropene	Accept cyclobutane or methylcyclopropane Ignore but-1-ene structure	1
	e	i		colourless / decolorised	Ignore clear	1
		ii		$C_2H_4Br_2$	Insist on correct use of subscripts and cases of letters Do not penalise elements in different order Accept correct structural/displayed formula	1
					Total	**14**

Question number			Answer	Notes	Marks
6	a	M1	(same) volume of solution/liquid	Accept amount in place of volume	3
		M2	(same) concentration (of solution/liquid)		
		M3	(same) amount of metal	Accept solid in place of metal Accept moles/mass in place of amount Reject salt in place of metal	
		M4	(same) (total) surface area / state of subdivision of solid	Accept all powder / all particles same size / size of metal	
		M5	(same) method/length of time/speed of stirring		
				Ignore references to polystyrene cup / starting temperature	
				Any three for 1 each	
	b	M1	22.4	Ignore trailing zeroes and award 1 mark for both correct values in wrong order	1
		M2	17.7		1
		M3	4.7	Consequential on values used in M1 and M2 Reject –4.7	1

Question number				Answer	Notes	Marks
6	c	i	M1	magnesium / Mg		1
			M2	largest difference in (recorded) temperatures	DEP on M1 Do not accept results in place of temperatures Explanation must be comparative: Not just rises are 10.5 and 15.5 without reference to values for other metals Not just very different temperature changes Accept two temperatures furthest apart Not just largest temperature rise No penalty for quoting wrong difference, eg 4 C	1

Question number				Answer	Notes	Marks
6	c	ii	M1	magnesium / Mg		1
			M2	largest temperature rise/change	DEP on M1 Do not accept results in place of temperatures Accept answers stating most heat produced / most exothermic	1
		iii		silver/it is less reactive (than copper) / lower in the reactivity series OR no reaction	Must be implied comparison Accept copper more reactive than silver but not just silver is unreactive	1
					Reject references to differences in reactivities of silver and copper ions / silver and copper sulfate	
		iv		silver and X both have no temperature rise/change OR two metals show no temperature rise/change	Accept two metals did not react Accept two showed zero (temperature rises)	1
	d			$Zn + CuSO_4 \rightarrow Cu + ZnSO_4$	Ignore state symbols Accept correct ionic equation with or without spectator ions	1
					Total	**13**

Question number				Answer	Notes	Marks
7	a	i	M1	(A) reduced AND (B) oxidised	If first column blank, M1 can be scored from words in second column: eg reduction is gain of electrons in 2nd column for A scores M2 oxidation is gain of oxygen in 2nd column for B scores M3 Both above statements would score M1 as well If M1 wrong way round, then 0/3 If 1st column has oxidation ×2 or reduction × 2, then no M1, but it will sometimes be possible to award either M2 or M3 for a correct matching statement.	1
			M2	(A) gain of electrons	If species identified, must be correct, eg not aluminium gains electrons Ignore reference to loss of oxygen	1
			M3	(B) gain of oxygen	Ignore reference to loss of electrons	1
		ii	M1	$2O^{2-} \rightarrow O_2 + 4e^{(-)}$	Both formulae correct and on correct sides of equation	1
			M2		Balancing including electrons	1
					Accept electrons lost on LHS Accept $O^{2-} \rightarrow O + 2e^{(-)}$ followed by $2O \rightarrow O_2$	
		iii		electrodes burn /get smaller / decrease (in mass) / have to be replaced	Ignore erode / corrode / wear / damage	1

Question number				Answer	Notes	Marks
7	a	iv	M1	coke	Ignore coal / carbon Reject other raw materials such as limestone/haematite	1
			M2	produces heat / exothermic (reaction)	M2 independent Accept makes carbon dioxide which then produces CO/reducing agent	1
	b	i		carbonating drinks / in drinks		1
			M2	soluble (in water) / reacts with water	M2 dependent on M1 Accept just solubility, ignoring qualifying statements such as only slightly soluble, or only dissolves under pressure	1
			M3	fire extinguishers / putting out fires		1
			M4	denser than air / does not support combustion	Accept denser than oxygen Ignore does not burn M4 dependent on M3 Ignore references to covering / sitting on fire	1
					Accept M1+M2, and M3+M4 reversed	

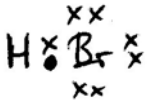
Question number				Answer	Notes	Marks
7	b	ii	M1	$SO_2 + H_2O \rightarrow H_2SO_3$	Accept $SO_2 + H_2O + ½O_2 \rightarrow H_2SO_4$	1
					Do not accept unconventional formulae such as SO_3H_2	
			M2	adverse effect on plants/trees/crops/vegetation OR adverse effect on fish / water animals / aquatic life OR adverse effect on iron/steel/metal OR adverse effect on stonework/limestone/marble	eg kills / harms / damages / destroys / stunts growth eg kills / harms / damages / destroys /reduces fish population eg damages / causes rusting/corrosion eg causes corrosion / damages Not just buildings/structures/statues Ignore changes in pH Ignore effects on animals/birds Ignore just habitats Do not accept burning/weathering/erosion as adverse effects Not just affects plants/fish/etc	1
					Do not apply list principle	

Question number				Answer	Notes	Marks
7	c		M1	$M_r(PbCO_3)$ = 267 / A_r (Pb) = 207	Accept 414 for Pb	1
			M2	n($PbCO_3$) / n(Pb) = 1.87 mol	Accept 1.9	1
			M3	m(Pb) = 387 – 388 g		1
				OR		
			M1	$M_r(PbCO_3)$ = 267 / A_r (Pb) = 207		1
			M2	m(Pb) = $\frac{207 \times 500}{267}$		1
			M3	m(Pb) = 387 - 388 g		1
				OR		
			M1	$M_r(PbCO_3)$ = 267 / A_r (Pb) = 207		1
			M2	% Pb = $\frac{207 \times 100}{267}$ = 77.5 %		1
			M3	m(Pb) = 500 × 0.775 = 387.5 g		1
					Correct final answer with or without working scores 3 Accept answer in kg Apply ECF throughout	
					Accept other valid methods 774-776 scores 2	
					Total	**17**

Question number				Answer		Notes	Marks
8	a	i	M1	reversible (reaction) / goes forwards and/or backwards / can go in either direction		Ignore equilibrium	1
			M2	enthalpy/heat/energy change		Ignore kJ/mol Reject energy produced/released	1
		ii		exothermic / heat/energy given out/lost		Accept enthalpy in place of heat/energy Ignore references to temperature	1
	b		M1	two (vaguely) horizontal lines: one with reactants or their formulae AND one with products or their formulae		Ignore all curves and connecting lines Ignore line representing *x*-axis and any label Accept R for reactants and P for products	1
			M2	reactants (line) above products (line)		No penalty for products to left of reactants	1
						Accept formulae in place of words for reactants and products Do not penalise minor errors in formulae (e.g. NH instead of NH_3) or missing coefficients	
	c		M1	(effect of temp on rate)	increased		1
			M2	(effect of temp on yield)	decreased		1
			M3	(effect of catalyst on rate)	increased		1
			M4	(effect of catalyst on yield)	unchanged		1

Question number				Answer	Notes	Marks
8	d	i	M1	decreased	No ECF from increased / no effect Accept longer time for reaction Ignore references to equilibrium	1
			M2	particles further apart/more widely spaced / more space to move in / concentration decreases	Accept molecules Reject atoms/ions in M2 only If neither of M2 and M3 scored, accept fewer collisions with no reference to frequency or time	1
			M3	less frequent (successful) collisions / fewer (successful) collisions per second/minute	Accept more time between collisions Ignore decreased chance / probability / likelihood of collisions	1
					References to change in energy/speed of particles means M2 and M3 cannot be scored	
		ii	M1	shifted to right / more products / shifts in exothermic/forward direction	Ignore references to rate No ECF from shift to left / no change Accept forward reaction favoured	1
			M2	more (gas) moles/molecules on right	Accept fewer (gas) moles on left Accept favours side with more (gas) moles Accept 9 moles on left and 10 moles on right	1
	e			4 (1) 2 4	Accept fractions and multiples	1
					Total	**15**

Question number				Answer	Notes	Marks
9	a	i	M1	35 on lines 1 and 3		1
			M2	44 on line 2		1
		ii		isotopes		1
		iii		same number of electrons (in outer shell) OR same electron arrangement or configuration	Ignore references to protons and neutrons unless incorrect, eg different numbers of protons, same number of neutrons	1
		iv	M1	^{79}Br	Accept just 79	1
			M2	79 is closer to 79.9/more accurate value	Accept 79 is closer to relative atomic mass M2 dependent on M1	1

Question number				Answer	Notes	Marks
9	b	i	M1		shared pair of electrons	1
			M2		other electrons correct (not necessary to be paired)	1
					M2 dependent on M1 Accept any combinations of dots and crosses Circles not needed but if drawn must overlap or touch – if not, then 0/2 Ignore inner electron shells even if incomplete or incorrect	
					Do not penalise incorrect symbols, eg br/BR If Na used in place of H, max 1 No marks if ions shown	
		ii	M1	shared (two/pair of) electrons	Not share an electron	1
			M2	attracted to <u>both</u> nuclei	M2 dependent on M1 or near miss eg the electrons are attracted to the nucleus scores 0 the electrons are attracted to both nuclei scores M2 but not M1	1
					0/2 if references to ions / ionic bond / intermolecular forces	

Question number				Answer	Notes	Marks
9	b	iii	M1	(sodium bromide) ionic bonding / + and − ions	Reject covalent bonding / shared electrons	1
			M2	(hydrogen bromide) attraction between molecules / intermolecular forces (of attraction)	Accept dipole-dipole attractions / van der Waals' forces / IMF / vdW Ignore hydrogen bonds Reject ions/ionic	1
			M3	ionic bonding stronger OR IMF / attractions between HBr molecules weaker	Accept ionic bonds stronger M3 dependent on comparison of intermolecular forces and ionic bonding Accept correct references to energy needed to overcome bonding / attractions	1
					Ignore references to reactivity and mass	

Question number				Answer			Notes	Marks
9	c		M1	Na $\frac{13.8}{23}$	Br $\frac{47.9}{80}$	O $\frac{38.3}{16}$	0/3 if division by atomic number(s) /division wrong way round If only two elements shown correctly, only M1 can be awarded	1
			M2	0.6	0.6	2.4	Accept 1 : 1: 4	1
			M3	$NaBrO_4$			Accept elements in any order Penalise M3 for incorrect symbol, eg $SBrO_4$ or $NaBO_4$	1
							Dividing by 160 instead of 80 gives Na2BrO8 Dividing by 32 instead of 16 gives NaBrO2 Award 2 in these cases Both these errors give Na2BrO4 Award 1 in this case	
							Correct final answer scores 3 marks	
							Total	**16**

Question number				Answer	Notes	Marks
10	a			organic compounds flammable OR decreases chance of fire OR less vapour/gas escapes	Ignore references to breaking boiling tube / beaker/escape of mercury / need to hold boiling tube / being burned by flame / loss of heat Ignore liquid escapes Accept stops/prevents vapour escaping Reject references to reactions inside the beaker	1
10	b	i	M1 M2	all five points correct	to nearest gridline Deduct 1 mark for each error If points not visible, assume they are under the line	2
			M3	straight line of best fit	Must be drawn with a ruler Does not need to be extrapolated Line should go through any two correctly plotted points	1
		ii		correct qualitative relationship	eg boiling point increases as relative formula mass increases / positive correlation Accept statement "wrong" way round Reject mass in place of relative formula mass Reject temperature in place of boiling point Reject (directly) proportional	1
		iii		117 (ºC) ±1º	CQ on candidate graph	1
		iv		E		1
					Total	**7**

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