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Mark Scheme (Results)

January 2012

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

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INTERNATIONAL GCSE CHEMISTRY **4CH0 4SC0 /1C – JANUARY 2012**

Question number				Answer	Notes	Marks
1	a		M1	beaker	Accept phonetic spellings	1
			M2	water		1
			M3	glass rod		1
			M4	funnel		1
			M5	conical flask		1
			M6	water		1
	b	i	M1	(filter) paper	Accept phonetic spellings Ignore alternatives to filter, such as kitchen / chromatography - the essential word is paper	1
		ii	M1	sand	Accept phonetic spellings	1
	c		M1	cross in box 4		1
			M2	cross in box 5		1

Total 10 marks

Question number				Answer	Notes	Marks
2	a	i	M1	(hydrated) iron(III) oxide / Fe_2O_3	Allow (hydrated) iron oxide and $Fe_2O_3.xH_2O$	1
		ii	M1	oxygen / O_2	Allow air Do not accept O	1
			M2	water / H_2O	Accept poorly written formulae such as H2O and O^2 Accept phonetic spellings Answers can be in either order Reject salt / acid - eg salt water does not score	1
	b		M1	cross in box 4 (oxidation)		1
	c	i	M1	Zinc / Zn	Accept phonetic spellings	1
		ii	M1	cross in box 2 (Bucket)		1
	d		M1 M2	oiling / greasing / painting / covering with plastic / coating with tin or named metal (aluminium or below) in reactivity series / attaching magnesium or zinc blocks (to ships)	Any two for 1 each Ignore sacrificial protection and galvanising and alloying	2

Total 8 marks

Question number				Answer	Notes	Marks
3	a		M1	NH_4^+	Award 1 if wrong way around	1
			M2	Cl^-	Penalise missing charges both times	1
	b	i	M1	(add) sodium hydroxide/NaOH (solution) (and warm)	Accept any identified Group 1 or Group 2 hydroxide If no reagent added, max 1 mark for correct test AND result even if dipped into solution If just hydroxide or OH^- ions, do not award M1 but continue marking If any other incorrect reagent added, then 0/3	1
			M2	test (gas / ammonia) with (damp red) litmus (paper) OR test with hydrogen chloride / conc HCl	Accept use of universal indicator Accept holding litmus above tube etc Reject blue litmus for M2 and M3 Do not penalise ammonium instead of ammonia in M2 Do not allow (dilute) hydrochloric acid	1
			M3	(litmus paper) turns blue OR <u>white</u> smoke/solid/powder	Do not award M3 if litmus dipped into solution (even if only implied)	1
		ii	M1	(add) silver nitrate/$AgNO_3$ (solution)	If missing or incorrect reagent, 0/3	1
			M2	(dilute) nitric acid	Do not accept any other acid or just acidified If acid missing or wrong, M3 can still be awarded	1
			M3	white precipitate / solid / suspension	If bleaching litmus paper mentioned, only M1 can be awarded	1

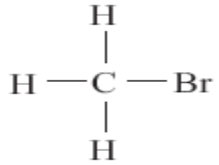
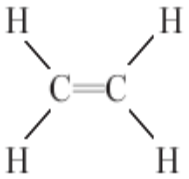
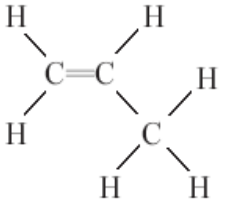
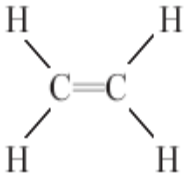
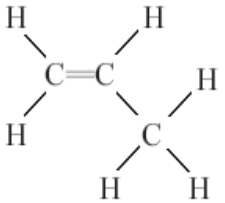
Question number				Answer	Notes	Marks
3	c		M1	reversible / goes both ways	Ignore equilibrium	1
	d	i	M1	ammonium chloride / NH_4Cl	Do not accept ammonia chloride If name and formula given, both must be correct	1
		ii	M1	ammonia / NH_3 / molecules / they / it are / move / diffuse /travel faster / quicker	Ignore descriptions such as lighter / smaller / denser Accept phonetic spellings including amonia / ammonium Do not accept hydrogen chloride / hydrochloric acid / HCl / ammonium chloride / NH_4Cl in place of ammonia Accept all other words with same meaning as faster - eg speedier Do not accept react faster or travel further Accept reverse statements such as hydrogen chloride slower	1
	e		M1 M2	Corrosive / burns / damages skin or eyes Wear eye protection eg goggles or mask / gloves / place bung in the end of the tube / use of fume cupboard	Ignore harmful / irritant / toxic / poisonous Allow tongs / tweezers if reference to cotton wool Ignore lab coats M1 and M2 are independent	**1** **1**

Total 11 marks

Question number				Answer	Notes	Marks
4	a	i	M1	bubbles / fizzing / effervescence OR solid/magnesium disappears/dissolves OR flask gets warm	Allow just gas (given off) Ignore wrongly named gas Allow temperature increases but not heat produced	1
		ii	M1	magnesium chloride / $MgCl_2$	Accept phonetic spellings Accept poorly written formulae such as $MGCl_2$ and $MgCL_2$	1
	b	i	M1 M2	$2H_2 + O_2 \rightarrow 2H_2O$	correct formulae = 1 balancing = 1 Ignore heat anywhere Ignore state symbols	1 1
		ii	M1	condensation	Accept phonetic spellings	1
	c	i	M1	blue	Do not accept any other colours even in combination with blue, eg blue-green Accept phonetic spellings Ignore qualifiers such as pale / dark / light Ignore mention of solution / liquid / solid	1

Question number				Answer	Notes	Marks
4	c	ii	M1 M2	measure boiling point / melting/freezing point OR distil / boil / freeze 100 ºC / 0 ºC	Ignore heat and cool Value must match property Accept º or C in place of ºC Do not award M2 if only value given Ignore evaporates M2 dependent on M1	1 1

Total 8 marks

Question number				Answer	Notes	Marks
5	a	i	M1	S	Accept diagram: 	1
		ii	M1	T / U	Accept diagrams:  / 	1
		iii	M1	T / U	Accept diagrams:  /  Do not penalise if both T and U are given Do not award the mark if either or both of T or U is given and any other letter is included	1

Question number				Answer	Notes	Marks
5	b		M1 M2	(add) bromine (water) decolourised / goes colourless	If bromide, then 0/2 Do not allow bromine in UV light, but M2 can be awarded Ignore starting colour of bromine Ignore clear / discolours Reject bleached	1 1
	c		M1	displayed formula of but-1-ene, but-2-ene or methylpropene	All atoms and bonds must be shown Allow dienes	1
	d	i	M1	C_nH_{2n+2}	Accept x and other letters in place of n Accept answers like $C_nH_{2n}+2$ Ignore brackets	1
		ii	M1 M2 M3 M4	same/similar chemical properties / reactions / behaviour / characteristics gradation /gradual change / trend / increase / decrease of physical properties (neighbouring members) differ by CH_2 same functional group	Ignore specific example such as react with oxygen Ignore similar (type of) reactivity Accept reference to specific property, eg boiling point Reject same / similar physical properties Any two for 1 each Accept two answers on one answer line	2

Question number				Answer	Notes	Marks
5	e		M1 M2	(compounds / molecules with) same molecular formula / same number of each type of atom different structures / structural formulae / atoms arranged differently / different displayed formulae	Ignore same chemical formula Ignore hydrocarbons If atoms or elements instead of compounds or molecules, max 1 for Q	1 1

Total 11 marks

Question number				Answer	Notes	Marks
6	a	i	M1	H—O—H with both bonds represented by 2 shared electrons	Accept 2 dots, 2 crosses or 1 of each Atoms do not have to be labelled with H or O If wrongly labelled, only M1 can be awarded	1
			M2	8 electrons in outer shell of O AND 2 electrons in outer shell of both H	Ignore inner shell of O Reject if H has 2 shells M2 dependent on M1	1
		ii	M1	(strong electrostatic) attraction between bonding/shared pair of electrons	Must refer to pair or two electrons	1
			M2	and nuclei (of hydrogen and oxygen)	Accept word nucleus instead of nuclei if clear reference to 2 atoms 0/2 if any mention of ions / electron transfer M2 dependent on mention of both attraction and electrons in M1	1

Question number				Answer	Notes	Marks
6	b	i	M1	idea of electron transfer / loss and gain of electrons		1
			M2	direction of transfer, eg sodium to oxygen / sodium loses and oxygen gains		1
			M3	correct number of electrons involved, eg (each) sodium loses 1 and oxygen gains 2	Ignore charges on ions Ignore covalent 0/3 if any mention of electron sharing All marks may be scored on diagrams or by reference to electronic configurations Max 2 if molecules mentioned	1
		ii	M1	(sodium) loses electron(s)	Ignore oxygen gains electrons	1

Question number				Answer	Notes	Marks
6	c		M1 M2	attractions between water molecules are weak(er) / easily overcome / need little energy to break attractions between (sodium and oxide) ions are strong(er) / ionic bonds are strong /need a lot of energy to break	Allow (named) intermolecular forces in place of attractions Do not award M2 if any mention of intermolecular forces / metallic bonding Any implication of <u>breaking</u> covalent bonds = 0/2	1 1

Question number				Answer	Notes	Marks
6	d	i	M1 M2 M3	s l aq	All three correct = 2 marks Two correct = 1 mark One/none correct = 0 marks Do not award M1 for g or if not possible to be sure that it is s and not g Do not award marks for abbreviations such as sol / liq	2
		ii	M1 M2	blue / purple OH^- / hydroxide	Allow indigo or violet M1 and M2 independent	1 1

Total 14 marks

Question number				Answer	Notes	Marks
7	a	i	M1	Chlorine / /Cl_2	Allow Cl Accept phonetic spellings Do not penalise poorly written formulae such as CL / cl / cL	1
			M2	Iodine / I_2	Allow I Accept phonetic spellings	1
		ii	M1	Astatine / At_2	Allow At Accept phonetic spellings Do not penalise poorly written formulae such as AT / at / aT	1
	b		M1 M2	$H_2 + Cl_2 \rightarrow 2HCl$	correct formulae = 1 balancing = 1 Max 1 for symbol or formula error, eg HcL, Cl^2	1 1

Question number				Answer	Notes	Marks
7	c	i	M1	red		1
			M2	(hydrochloric) acid / hydrogen ions / H^+ (formed)	Ignore acidic and references to pH	1
		ii	M1	blue	Allow no colour change Do not accept changes (from red) to blue	1
			M2	no reaction/acid/hydrogen ions/H^+ (formed)	Reject any reference to alkaline Ignore not acidic and references to pH Ignore reference to not dissolving	1

Total 9 marks

Question number				Answer	Notes	Marks
8	a		M1	exothermic	Accept phonetic spellings Do not accept endothermic or any spelling that could be taken as endothermic or a hybrid such as exdothermic	1
	b	i	M1 M2 M3 M4 M5 M6	volume of solution concentration (of solution) amount / mass of metal same surface area of metal same (rate/time of) stirring same <u>starting/initial</u> temperature	Allow amount of solution Allow quantity of metal Allow same size pieces / same state of subdivision Ignore references to room temperature Any two for 1 each	1 1 1 1 1 1
		ii	M1 M2 M3	18.7(0) 26.8(0) 8.1(0)	 Conseq on M1 and M2	1 1 1
		iii	M1 M2	Zn / zinc X	Accept phonetic spellings	1 1

Question number				Answer	Notes	Marks
8	c		M1	$Zn + XSO_4 \rightarrow ZnSO_4 + X$	Ignore state symbols	1
	d		M1	would react with water OR forms insoluble calcium sulfate/product	Allow <u>too</u> reactive/<u>very</u> reactive/<u>too</u> high in the reactivity series Do not allow more reactive than other metals (in experiment)	1

Total 10 marks

Question number				Answer	Notes	Marks
9	a	i	M1	air / atmosphere		1
			M2	water / natural gas / hydrocarbons	Allow methane	1
		ii	M1	iron / Fe	Ignore iron oxide Accept phonetic spellings Do not penalise other included numbers - eg Fe(II) / Fe(III) / Fe^{2+} / Fe^{3+}	1
		iii	M1	450 ºC	Accept temperature of 350ºC to 550ºC or temperatures in K If range given, both values must be within acceptable range	1
			M2	200 atm(ospheres)	Accept pressure of 150 atm to 250 atm or pressures in Pa Unit needed for mark If two conditions given, both must be correct	
		iv	M1	cooled / temperature lowered		1
			M2	ammonia liquefies / condenses	M1 and M2 are independent Do not award M2 if implication that other gases condense	1

Question number				Answer	Notes	Marks
9	b		M1	$n(N_2) = (56 \times 10^6) \div 28 \quad / \quad 2 \times 10^6$	No penalty for missing or incorrect power of 10	1
			M2	$n(NH_3) = M1 \times 2 / 4 \times 10^6$	Conseq on M1	1
			M3	$m(NH_3) = M2 \times 17 / 68$ t(onnes)	Conseq on M2 Correct final answer with units scores 3 Accept answers in grams and kilograms 34 t scores 2 marks Final answer of 68 with missing or incorrect units scores 2	1
				OR $\frac{34 \times 56}{28}$ = 68 t(onnes)	M1 for 28 and 34 (need not be in this expression) M2 is for expression shown M3 is for answer with units	
	c	(i)	M1	increased		1
			M2	shift to left	Allow less ammonia / products Allow moves in reverse direction Ignore reference to favouring	1
		(ii)	M1	shift to right	Allow more ammonia / products Allow moves in forward direction Ignore reference to favouring	1
			M2	fewer moles/molecules (of gas) on the right	Allow more moles/molecules on the left Do not penalise incorrect numbers, eg 3 moles on the left and 2 moles on the right Ignore references to rate M2 dependent on M1	1

Question number				Answer	Notes	Marks
9	d	i	M1	60		1
		ii	M1	setting out correct division of each % by A_r OR 2.5, 5 and 3.75	Award 0 for whole question if division by atomic numbers / wrong way up / multiplication used If molecular masses used for all three elements, no M1, but can award M2 and M3	1
			M2	division by smallest (gives 1 : 2 : 1.5)	No penalty for subsequently rounding 1.5 to 2 if clear they have divided by smallest	1
			M3	$N_2H_4O_3$	Accept elements in any order Allow NH_4NO_3 If % O wrong or missing, only M1 and M2 can score	1
		iii	M1	ammonium nitrate	Accept phonetic spellings Do not accept ammonia in place of ammonium Do not accept nitrite or nitride in place of nitrate Ignore all formulae	1

Total 18 marks

Question number				Answer	Notes	Marks
10	a	i	M1	layers / sheets / planes / rows of (positive) ions	Allow atoms/ particles in place of positive ions Reject molecules / protons / electrons	1
			M2	slide (over each other)	Allow slip / flow / move in place of slide Accept explanation in terms of non-directional bonding Do not award M2 if protons / electrons Do not award M2 if no mention of layers or equivalent	1
		ii	M1	delocalised electrons / sea of electrons	Ignore free electrons	1
			M2	move / flow (through structure) / mobile (when voltage/potential difference applied)	M2 needs mention of electrons Any mention of ions moving = 0/2	1

Question number				Answer	Notes	Marks
10	b	i	M1	green precipitate	Accept solid / suspension Ignore qualifiers such as pale / light / dark / muddy / dirty Ignore grey Ignore references to <u>turning</u> brown Reject bubbles or equivalent Do not penalise wrong identity of precipitate	1
			M2	brown precipitate	Accept solid / suspension Accept orange / orange-brown / red-brown Ignore qualifiers such as pale / light / dark Reject bubbles or equivalent Do not penalise wrong identity of precipitate Award 1 for both colours correct but precipitate missing	1
		ii	M1	$FeSO_4 + 2NaOH \rightarrow Fe(OH)_2 + Na_2SO_4$	Correct formulae = 1	1
			M2		Balancing = 1	1

Total 8 marks

Question number				Answer	Notes	Marks
11	a		M1	(total) volume different/not constant / not 50 / is 55	Allow too much water / sodium thiosulfate added / reference to numbers eg should be 10 instead of 15 or 35 instead of 40	1
	b		M1 M2 M3	All six points plotted correctly to nearest gridline <u>curve</u> of best fit	Deduct 1 mark for each error If plotting cannot be seen judge accuracy from the line. Do not award mark for joining dots or multiple lines or if all of the data points are completely misplotted	2 1
	c		M1 M2	1000 ÷ 26.6 37.6	 Ignore units M2 can be awarded for use of another student's result Award 2 marks for correct final answer Award 1 mark for 38 / 37.59 / 37.5	1 1

Question number				Answer	Notes	Marks
11	d	i	M1 M2	rate (directly) proportional to concentration	Accept concentration (directly) proportional to rate Accept specific quantitative expression, eg rate doubles as concentration doubles Allow 1 mark for qualitative expression, rate increases as concentration increases	2
11	d	ii	M1 M2 M3	more particles / ions (in a given volume) collide (successfully) more frequently	Reject atoms / molecules Reject with more energy Ignore greater chance of collision Must be reference to frequency or number of collisions per unit time Allow "increased frequency of collisions" for M2 and M3	1 1 1

Total 11 marks

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