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Mark Scheme (Results)

Summer 2012

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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INTERNATIONAL GCSE CHEMISTY PAPER 1C – SUMMER 2012

Question number	Expected Answer			Accept	Reject	Marks
1 (a)				Ignore extra apparatus on top of tripod eg beaker Minimum is 2 vertical or diagonal lines with something on top		6
		measuring cylinder	B			
	 Or 2D diagram		C Ignore D			
		(top pan) balance /scale(s) / weighing machine	A or E			
	1 mark for each correct answer					

Question number	Expected Answer	Accept	Reject	Marks
1 (b)	M1 wear (safety) glasses / spectacles / goggles / eye protection M2 salt /solution / water may spit out (when evaporating the salty water) / may get in your eye IGNORE references to hazards eg toxic / irritant OR M1 use (beaker) tongs / hot hand / (rigger/oven) glove(s) (to remove / lift the basin) M2 basin will / may be hot OR M1 tie hair back / tuck in tie M2 might catch fire (in Bunsen burner) the reason must match the precaution IGNORE references to wearing lab. coats / protective clothing	It leave basin (to cool) <u>before removing</u> to avoid burning hand	crucible tongs / plastic gloves	1 1
(c)	(2.9 x 2) = 5.8 (g)			1

Question number	Expected Answer	Accept	Reject	Marks
2 (a) (i)	M1 calcium M2 magnesium	Ca Mg	any other answers	1 1
(ii)	iron / zinc	Fe / Zn	any other answers	1
(iii)	calcium magnesium zinc iron copper M1 for calcium as most reactive M2 for copper as least reactive M3 for remainder in correct order	Ca Mg Zn Fe Cu		3
(b) (i)	hydrogen / H_2		H	1
(ii)	all the (sulfuric) acid has reacted / all hydrogen (ions) have been replaced (by magnesium (ions)) OR acid has been used up/been neutralised / acid has run out IGNORE the acid is saturated / excess magnesium has been added	sulphuric for sulfuric hydrogen ions / H^+ for acid	all the magnesium / reactants used up	1
(iii)	magnesium sulfate (solution) IGNORE incorrect formula	sulphate for sulfate $MgSO_4$		1
(iv)	filtration / filter (it / magnesium / solution) / decantation / decant (off the water / solution) IGNORE references to distillation / centrifuging / washing / evaporation after filtration	description of filtration	sieve crystallisation	1

2 (c)	(i)	exothermic			1
	(ii)	magnesium oxide IGNORE incorrect formula	MgO		1

Question number	Expected Answer	Accept	Reject	Marks
3 (a)	M1 precipitate of barium sulfate	sulphate for sulfate insoluble barium sulphate / $BaSO_4$	incorrect name of ppt.	1
	M2 no precipitate	no (visible) change solution (formed)		1
	M3 precipitate of calcium sulfate IGNORE colours penalise incorrect extra observations (e.g. effervescence) ONCE only For M1 and M3 only: if only precipitate appears twice (with no names), penalise <u>missing</u> names once only if only names correct (with no precipitates), penalise omission of precipitate once only	sulphate for sulfate insoluble calcium sulfate / $CaSO_4$	incorrect name of ppt.	1

Question number	Expected Answer	Accept	Reject	Marks
3 (b)	aq aq s aq			1
(c) (i)	obtain the lead(II) bromide/the residue/the solid OR remove the liquid/solution/potassium nitrate/water	separate the solid and liquid		1
(ii)	to wash away/remove the (remaining) potassium nitrate / lead(II) nitrate / potassium bromide / solution IGNORE clean	wash away / remove (remaining soluble) impurities to make it pure	make the mixture pure	1
(iii)	distilled water is pure / does not contain (dissolved) impurities / ions / substances / compounds / other chemicals (that would contaminate the lead(II) bromide) / residue / solid) IGNORE elements IGNORE references to distilled water being cleaner (ORA)	reverse argument for tap water	any suggestion that the water / impurities react	1
(iv)	to evaporate the water / to dry (the solid/crystals) / increase rate of evaporation (of water) IGNORE liquid	to avoid decomposition (if heated strongly)	to evaporate the potassium nitrate / solution any reference to crystallisation	1

Question number	Expected Answer	Accept	Reject	Marks
4 (a)	(increasing) atomic number(s) IGNORE references to electrons / electronic configurations	proton number / number of protons	mass number / RAM	1
(b) (i)	sodium / potassium	Na / K		1
(ii)	fluorine / chlorine / bromine	F / Cl / Br / F_2 / Cl_2 / Br_2	fluoride / chloride / bromide	1
(c) (i)	sodium OR potassium <u>AND</u> fluorine OR chlorine OR bromine OR hydrogen Answers can be in either order IGNORE incorrect symbols/formulae if names are correct	Na / K F / Cl / Br / H / F_2 / Cl_2 / Br_2 / H_2	 fluoride / chloride / bromide / hydride	1
(ii)	Marks do not have to be CQ on (c)(i), and all marks can be scored here for correct diagrams of the ions in a hydrogen halide M1 Na or K with 8 electrons M2 F, Cl or Br with 8 electrons IGNORE diagrams showing initial electron configurations M3 (1)+ <u>AND</u> (1)– charges correct IGNORE inner shells even if incorrect	0 electrons H with 2 electrons	Incorrect electron transfer for M1 and M2	1 1 1

	Allow any combination of dots and crosses If shown covalently bonded, then max. 1 for correct charges if given If the position of 2 electrons shown between the two species makes it hard to be sure that the bonding is definitely ionic (and not covalent), do not award M1 or M2			

Question number	Expected Answer	Accept	Reject	Marks
4 (d)	(fluorine reacts) vigorously / instantly / explosively / violently / very quickly / very rapidly IGNORE references to electron transfer, even if incorrect	the quickest / more quickly than chlorine	fluorine reaction slower than chlorine reaction	1
	(to form) iron(III) fluoride	ferric fluoride / FeF_3		1

(e)	M1 colourless (IGNORE clear)	no colour	decolourised	1
	M2 orange / yellow /brown IGNORE qualifiers such as light / dark	any combination of colours on left	any other colour	1

Question number	Expected Answer	Accept	Reject	Marks
5 (a)	$2H_2O_2 \rightarrow 2H_2O + O_2$ M1 all formulae correct (including catalyst if given) M2 correct balancing M2 DEP on M1 If catalyst included in equation, must be MnO_2 on both sides IGNORE MnO_2 above the arrow	$H_2O_2 \rightarrow H_2O + ½O_2$ multiples		2
(b)	relights a glowing spill IGNORE reference to popping	splint for spill smouldering/embering for glowing		1
(c)	M1 (rate) increases M2 provides an alternative pathway / route / mechanism (for the reaction) OR hydrogen peroxide) particles / molecules / reactant(s) adsorb (onto catalyst) M3 with a lower activation energy OR more particles / molecules have the (required) activation energy OR weakens the (covalent) bonds (in the hydrogen peroxide)	speeds up / goes faster / decreases time (for decomposition) lowers the activation energy by going a different way = M2 and M3 Absorb / sticks to / bonds to /provides a surface for particles /molecules / reactant(s) to react description of activation energy eg particles have enough energy to react	 gives particles more kinetic energy for M2 and M3 atoms atoms	1 1 1

Question number	Expected Answer	Accept	Reject	Marks
5 (d) (i)	M1 curve starting at origin and below original curve			1
	M2 levelling off at 30 cm^3 (+/- 0.5) and anywhere between 30s and 120s	curve reaching right vertical axis below 30cm^3 but still 'going up'		1
(ii)	M1 curve starting at origin and above original curve			1
	M2 levelling off at 60 cm^3 (+/- 0.5) and before 80s			1
	if curves incorrectly labelled then penalise each curve 1 mark, so max. 2 for the question	both curves unlabelled		

Question number	Expected Answer	Accept	Reject	Marks
6 (a)	M1 both protons = 6 M2 C-13 has 7 and C-14 has 8 (neutrons)			1 1
(b)	same electronic configuration(s) / structure(s) OR same <u>number</u> of electrons OR have <u>four/same number of</u> electrons in <u>outer / valence</u> shell IGNORE same number of electrons in inner shells IGNORE references to atomic number / same number of protons / different number of neutrons	amount for number / six electrons	different number of protons	1
(c) (i)	M1 the average / mean mass of an <u>atom</u> (of the element) M2 compared to / relative to ($1/12^{th}$) the mass (of an atom) of carbon-12 OR M1 mass of one mole of <u>atoms</u> M2 compared to (mass of) $1/12^{th}$ one mole / 1g of carbon-12	average/mean of: atomic masses / mass numbers / mass of isotope<u>s</u> on a scale where carbon-12 has a mass of 12 / compared with the mass of carbon-12 which is 12	mean mass of an element mass of one mole of the element	1 1

Question number	Expected Answer	Accept	Reject	Marks
6 c (ii)	M1 (12 x 98.9) + (13 x 1.1) M2 ÷ 100 M3 12.01 IGNORE units	(12 x 0.989) + (13 x 0.011) for first 2 marks 12.011 on its own for 2 marks 12.01 on its own for 3 marks		1 1 1

Question number	Expected Answer	Accept	Reject	Marks
7 (a) (i)	M1 contains carbon and hydrogen (atoms / elements / particles)	C and H for carbon and hydrogen	ions / carbon molecules / hydrogen molecules / H_2 / mixture of C and H	1
	M2 only	other equivalent words, eg solely / entirely / completely		1
	M2 DEP on M1, but allow M2 if molecules / ions / mixture used in M1			
(ii)	$C_{10}H_{22}$ IGNORE structural formula	$H_{22}C_{10}$	Reject superscripts / lower case c or h / full size numbers	1
(b) (i)	addition	additional		1
(ii)	M1 one of the bonds in the double bond breaks	double bond breaks / double bond becomes single bond changes (from unsaturated) to saturated		1
	M2 (many) ethene(s)/molecules/monomers join (together) OR (many) ethene(s)/molecules/monomers form a chain			1

Question number	Expected Answer	Accept	Reject	Marks
7 (c)	Any 4 from: • produces smaller / shorter (chain) molecules • smaller / shorter (chain) molecules more useful (as fuels) / have greater demand • smaller / shorter (chain) molecules burn more cleanly /are used to make petrol/diesel/fuel for vehicles • crude oil richer in / has a surplus of long (chain) molecules • produces alkenes / any named alkene • alkenes used to make alcohol / polymers / plastics / chemical feedstock / any named addition polymer	ORA low(er) demand products converted to high(er) demand products ORA		4

Question number	Expected Answer	Accept	Reject	Marks
8 (a) (i)	diffusion			1
(ii)	ammonia because it moves further (in the same time) / ammonia moved 60cm and hydrogen chloride moved 40cm OR ammonia because (white) ring right of centre / ring is further from ammonia end / closer to HCl end Do not penalise atoms in place of molecules/ particles	reverse arguments ammonia has lower density / has lighter molecules / smaller M_r references to solutions IGNORE smaller molecules		1
(b)	M1 less than 5 mins / less time (for white ring to form) M2 particles / molecules have more (kinetic) energy M3 and particles/gas move(s) / diffuse faster IGNORE references to rate of reaction / more (successful/frequent) collisions Do not penalise atoms in place of molecules/particles	(forms more) quickly / sooner	gas has more energy	1 1 1

Question number	Expected Answer	Accept	Reject	Marks
8 (c)	particles/molecules collide with air particles/molecules in air OR particles / molecules collide with one another / the wall (of the tube) Do not penalise collisions between ammonia and hydrogen chloride OR particles move in random direction / need many collisions (for white ring) to become visible / many particles of ammonium chloride must form (before white ring seen) Do not penalise atoms in place of molecules/ particles IGNORE references to time taken for evaporation to take place IGNORE references to time taken for reaction to take place			1

Question number	Expected Answer	Accept	Reject	Marks
9 (a)	silicon dioxide is acidic	an acid		1
	calcium oxide is basic / a base	calcium oxide is alkaline / an alkali If neither mark scored, award 1 mark for: reaction is neutralisation OR reaction is between an acid and a base/alkali (even if wrongly identified)		1

Question number	Expected Answer	Accept	Reject	Marks
9 (b) (i)	M1 oxygen (atom)		oxygen molecule / O_2 / oxide ion /oxygen ion	1
	M2 forms two bonds / smaller atom / has valency of 2 IGNORE more (oxygen) in the formula	more of them (n the diagram / structure)		1
	M2 DEP on M1, although allow M2 if oxygen mentioned but M1 not awarded because of reference to molecule/ion/O_2			
(ii)	M1 giant (structure / lattice / atomic) IGNORE large / 3D	giant molecular / macromolecular		1
	M2 covalent			1
	M3 idea that covalent bonds are broken IGNORE bonds are loosened	overcome for broken		1
	M4 covalent bonds are strong / lots of energy required to break covalent bonds/ lots of heat required to break covalent bonds IGNORE high temperature needed	many bonds are broken = M3 + M4		1
	Do not penalise silicone			
	Max2 for mention of ionic or metallic bonding or intermolecular forces			
	Max 3 if discussing diamond / carbon			

Question number	Expected Answer	Accept	Reject	Marks
10 (a) (i)	M1 Na (1.15 ÷ 23) = 0.05 (mol) O (0.80 ÷ 16) = 0.05 (mol) Accept correct alternative working		division by atomic numbers division upside down for M1 and M2	1
	M2 ratio 1:1	(moles are) the same/equal		1
	M2 DEP on M1			
(ii)	M1 78 ÷ 39 = 2	39 x 2 = 78 / 78 is twice 39		1
	M2 Na_2O_2	23x2=46 and 16x2=32 (= 78)		1
	Final answer scores 2			
(b) (i)	$Na_2O_2 + 2H_2O \rightarrow 2NaOH + H_2O_2$	multiples and fractions		2
	M1 all formulae correct M2 correct balancing	equation csq on formula in (a)(ii), but Na and O must be in 1:1 ratio		
	M2 DEP on M1			
(ii)	Hydroxide / OH^- / HO^- / ^-OH			1

Question number	Expected Answer	Accept	Reject	Marks
10 (b) (iii)	M1 two electrons between the oxygen atoms M2 all other electrons correct M2 DEP on M1 Allow any combination of dots and crosses			1 1

Question number	Expected Answer	Accept	Reject	Marks
11 (a) (i)	potassium / K^+	K		1
(ii)	iron(II) / Fe^{2+}			1
(iii)	iodide / I^-	I	iodine / I_2	1
(b)	M1 use a (clean platinum / nichrome) wire / glass rod / silica rod IGNORE references to hydrochloric acid	any method of introducing the solid into the flame, e.g. (wet) wooden spill / spatula / metal rod / tip or sprinkle in	any metal that will burn or melt in a flame (e.g. magnesium) or any metal that will colour the flame (e.g. copper) tongs / tweezers / (deflagrating) spoon	1
	M2 (to put) solid / solution / M <u>in/over</u> a flame/burner	powder		1
	M3 flame as either blue/roaring/non-luminous/Bunsen/blow torch OR burner described Bunsen/blow torch		luminous / yellow flame	1
	no marks if solid is in a container, e.g. test tube/tray/beaker/basin			

Question number	Expected Answer	Accept	Reject	Marks
11 (c) (i)	reacts with / removes carbonate (ions) OR remove ions/substances/impurities that (form a) precipitate (with silver ions / silver nitrate)	formula removes ions that give a positive result (with silver ions / silver nitrate)		1
(ii)	M1 (hydrochloric acid) contains chloride ions M2 which interfere with test / make silver chloride OR M1 forms a (white) precipitate M2 of silver chloride Do not award either mark if wrong chemistry described, eg redox reactions, formation of iodine	 gives a (white) precipitate / (false) positive result	chlorine ions	1 1
(d)	nitrate / NO_3^- If both name and formula given, both must be correct			1

Question number	Expected Answer	Accept	Reject	Marks
12 (a)	$2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$ M1 all formulae correct M2 correct balancing M2 DEP on M1 IGNORE state symbols	Multiples and fractions		2
(b) (i)	Reduced <u>AND</u> oxygen has been removed IGNORE It / PbO gains electrons Do not penalise molecules	arguments based on decrease in oxidation number of <u>Pb</u>/ gain of electrons by <u>Pb^{2+}</u> / lead ions		1
(ii)	M1 Mr (PbO) = 223 (moles method) M2 n (PbO) = 44.6/223 (=0.2) M3 mass of C = 0.2/2 x 12 = 1.2 (mass ratio method) M2 446 require 12 / 44.6 × $\frac{12}{446}$ M3 44. 6 require 1.2 / 1.2 Calculations with and without use of 10^6 are acceptable mark csq at each stage Correct final answer with or without working	446		1 1 1 1

	scores 3 Final answers that may score 2 are: 0.6 / 2.4 / 4.8 / 0.12 / 12			

Question number	Expected Answer	Accept	Reject	Marks
12 (c) (i)	(silver is / it is) <u>more</u> soluble in zinc / <u>less</u> soluble in lead	soluble in zinc but insoluble in lead		1
(ii)	(it is) less than / equal to 530 (°C)		implication that Zn and Ag melting points are both less than or equal to 530 °C	1
(iii)	M1 zinc/it is lower / silver is higher			1
	M2 zinc turns into a vapour / gas (when heated) while silver remains M2 DEP on M1 IGNORE references to melting point	boils off (as a gas) first when heated		1
(iv)	silver is expensive / valuable			1

Question number	Expected Answer	Accept	Reject	Marks
13 (a) (i)	4.83 (g)			1
(ii)	3.78 (g)			1
(iii)	M1 $n(ZnSO_4)$ = 4.83 ÷ 161 / = 0.03 M2 $n(H_2O)$ = 3.78 ÷ 18 / = 0.21 M3 x = $n(H_2O)$ ÷ $n(ZnSO_4)$ = 7 CSQ on (i) and (ii) Do not penalise non-integer values of x Correct final answer with no working = 1 Correct final answer with some <u>correct</u> working = 3	(18x ÷ 161) = (3.78 ÷ 4.83) x = ((3.78 ÷ 4.83) × 161) ÷ 18 = 7 equivalent alternative calculations		1 1 1
(b)	to remove all the water NOT just to remove the water	to make sure the solid is anhydrous / fully dehydrated		1

Question number	Expected Answer	Accept	Reject	Marks
13 (c)	M1 <u>anhydrous</u> / <u>white</u> copper sulfate IGNORE crystals M2 turns blue if oxidation number of copper given, must be +2 M2 DEP on M1 correct or near miss IGNORE references to determining melting and/or boiling point, even if incorrect IGNORE references to acid/base indicators or UI, even if incorrect	<u>anhydrous</u> cobalt chloride / <u>blue</u> cobalt chloride (solid or paper) turns pink if oxidation number of cobalt given, must be +2 copper sulfate turns from white to blue = 2 cobalt chloride turns from blue to pink = 2 dehydrated in place of anhydrous		1 1

PAPER TOTAL: 120 MARKS

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