

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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Publications Code UG031876

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INTERNATIONAL GCSE CHEMISTRY 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			
			C Ignore D			
	Or 2D diagram					
		(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)	<p>M1 wear (safety) glasses / spectacles / goggles / eye protection</p> <p>M2 salt /solution / water may spit out (when evaporating the salty water) / may get in your eye IGNORE references to hazards eg toxic / irritant</p> <p>OR</p> <p>M1 use (beaker) tongs / hot hand / (rigger/oven) glove(s) (to remove / lift the basin)</p> <p>M2 basin will / may be hot</p> <p>OR</p> <p>M1 tie hair back / tuck in tie</p> <p>M2 might catch fire (in Bunsen burner)</p> <p>the reason must match the precaution</p> <p>IGNORE references to wearing lab. coats / protective clothing</p>	<p>It</p> <p>leave basin (to cool) <u>before removing</u></p> <p>to avoid burning hand</p>	<p>crucible tongs / plastic gloves</p>	<p>1</p> <p>1</p>
(c)	$(2.9 \times 2) = 5.8 \text{ (g)}$			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)	<u>all</u> the (sulfuric) acid has reacted / <u>all</u> 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 <u>after</u> 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

<p>Allow any combination of dots and crosses</p>	<p>If shown covalently bonded, then max. 1 for correct charges if given</p>	<p>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</p>			
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Question number	Expected Answer	Accept	Reject	Marks
4 (d)	(fluorine reacts) vigorously / instantly / explosively / violently / <u>very</u> quickly / <u>very</u> rapidly IGNORE references to electron transfer, even if incorrect (to form) iron(<u>III</u>) fluoride	the quickest / more quickly <u>than chlorine</u> ferric fluoride / FeF ₃	fluorine reaction slower than chlorine reaction	1
				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)	$2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$ 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	$\text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \frac{1}{2}\text{O}_2$ 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			1
	(ii) M1 curve starting at origin and above original curve	both curves unlabelled		1
	M2 levelling off at 60 cm^3 (+/- 0.5) and before 80s if curves incorrectly labelled then penalise each curve 1 mark, so max. 2 for the question			1

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

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

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) <u>ethene(s)/molecules/monomers</u> join (together) OR (many) <u>ethene(s)/molecules/monomers</u> form a chain			1

Question number	Expected Answer	Accept	Reject	Marks
7 (c)	<p>Any 4 from:</p> <ul style="list-style-type: none"> • 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 	<p>ORA low(er) demand products converted to high(er) demand products</p> <p>ORA</p>		4

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

Question number	Expected Answer	Accept	Reject	Marks
8 (c)	<p>particles/molecules collide with air particles/molecules in air</p> <p>OR</p> <p>particles / molecules collide with one another / the wall (of the tube) Do not penalise collisions between ammonia and hydrogen chloride</p> <p>OR</p> <p>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)</p> <p>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</p>			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 Do not penalise silicone Max2 for mention of ionic or metallic bonding or intermolecular forces Max 3 if discussing diamond / carbon	many bonds are broken = M3 + M4		1

Question number	Expected Answer	Accept	Reject	Marks
10 (a)	(i) M1 Na ($1.15 \div 23$) = 0.05 (mol) O ($0.80 \div 16$) = 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 $78 \div 39 = 2$	$39 \times 2 = 78$ / 78 is twice 39		1
	M2 Na ₂ O ₂	$23 \times 2 = 46$ and $16 \times 2 = 32$ (= 78)		1
	Final answer scores 2			
(b)	(i) Na ₂ O ₂ + 2H ₂ O → 2NaOH + H ₂ O ₂ M1 all formulae correct M2 correct balancing M2 DEP on M1	multiples and fractions equation csq on formula in (a)(ii), but Na and O must be in 1:1 ratio		2
	(ii) Hydroxide / OH ⁻ / HO ⁻ / ⁻ OH			1

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

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)	<p>M1 use a (clean platinum / nichrome) wire / glass rod / silica rod</p> <p>IGNORE references to hydrochloric acid</p> <p>M2 (to put) solid / solution / M <u>in/over</u> a flame/burner</p> <p>M3 flame as either blue/roaring/non-luminous/Bunsen/blow torch</p> <p>OR</p> <p>burner described Bunsen/blow torch</p> <p>no marks if solid is in a container, e.g. test tube/tray/beaker/basin</p>	<p>any method of introducing the solid into the flame, e.g. (wet) wooden spill / spatula / metal rod / tip or sprinkle in</p> <p>powder</p>	<p>any metal that will burn or melt in a flame (e.g. magnesium) or any metal that will colour the flame (e.g. copper)</p> <p>tongs / tweezers / (deflagrating) spoon</p> <p>luminous / yellow flame</p>	<p>1</p> <p>1</p> <p>1</p>

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

Question number	Expected Answer	Accept	Reject	Marks
12 (a)	$2\text{PbS} + 3\text{O}_2 \rightarrow 2\text{PbO} + 2\text{SO}_2$ 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</u> ²⁺ / 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 $\times \frac{12}{446}$ 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

	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	implication that Zn and Ag melting points are both less than or equal to 530 °C	1
	(ii) (it is) less than / 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	1		
	M2 DEP on M1 IGNORE references to melting point			
(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)	<p>M1 $n(\text{ZnSO}_4) = 4.83 \div 161 \text{ / } = 0.03$</p> <p>M2 $n(\text{H}_2\text{O}) = 3.78 \div 18 \text{ / } = 0.21$</p> <p>M3 $x = n(\text{H}_2\text{O}) \div n(\text{ZnSO}_4) = 7$</p> <p>CSQ on (i) and (ii)</p> <p>Do not penalise non-integer values of x</p> <p>Correct final answer with no working = 1</p> <p>Correct final answer with some <u>correct</u> working = 3</p>	<p>$(18x \div 161) = (3.78 \div 4.83)$</p> <p>$x = ((3.78 \div 4.83) \times 161) \div 18$</p> <p>$= 7$</p> <p>equivalent alternative calculations</p>		<p>1</p> <p>1</p> <p>1</p>
(b)	<p>to remove all the water</p> <p>NOT just to remove the water</p>	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	<u>anhydrous</u> cobalt chloride / <u>blue</u> cobalt chloride (solid or paper)		1
	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	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

PAPER TOTAL: 120 MARKS

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