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Mark Scheme (Results)

Summer 2013

GCSE Chemistry (5CH2H)
Paper 01

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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.
- For questions worth more than one mark, the answer column shows how partial credit can be allocated. This has been done by the inclusion of part marks eg (1).
- 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.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:

- Write legibly, with accurate spelling, grammar and punctuation in order to make the meaning clear
- Select and use a form and style of writing appropriate to purpose and to complex subject matter
- Organise information clearly and coherently, using specialist vocabulary when appropriate.

Question Number	Answer	Acceptable answers	Mark
1(a)(i)	C cations in a sea of electrons		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	(metals have) high melting <u>point</u>	a lot of energy needed to break/overcome (metallic) bonds energy needed to break/overcome strong (metallic) bonds Ignore references to boiling point Reject reference to intermolecular forces/covalent (bonds) /attraction between ions/breaking ionic bonds/ breaking covalent bonds	**(1)**

Question Number	Answer	Acceptable answers	Mark
1(a)(iii)	An explanation including two of the following points • argon is inert/does not react/is unreactive (1) • because it has 8 electrons in its outer shell (1) • metals would react in/with air/oxygen (1) • argon will exclude air from welding point (1)	Ignore argon is in group 0/8 argon is a noble gas Ignore argon does not burn does not {gain/lose/share} electrons has a full outer shell (of electrons) has a stable electron configuration form (metal) oxide prevents oxidation	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(b)	$2\ Fe + 3\ Br_2 \rightarrow 2\ FeBr_3$ M1 Correct symbol/formulae (1) M2 balancing of correct symbol/formulae (1)	Reject incorrect use of upper/lower case / subscripts for M1 but allow ECF for M2	**(2)**

Question Number	Answer	Acceptable answers	Mark
1(c)	C – grey solid		**(1)**

Question Number	Answer	Acceptable answers	Mark
1(d)	A explanation including M1 order of reactivity chlorine > bromine > iodine (1) and M2 one of the following points • chlorine displaces bromine (from bromide) AND chlorine displaces iodine (from iodide) (1) • bromine displaces iodine (from iodide) AND bromine does not displace chlorine (from chloride) (1) • iodine does not displace chlorine(from chloride) AND iodine does not displace bromine (from bromide) (1)	For M1 reject reference to reactivity of halide ions eg chlorine more reactive than bromide halogens/they decrease in reactivity down the group/table chlorine is most reactive <u>and</u> iodine is least reactive Ignore reference to displacement of halide ions eg chlorine displaces bromide Ignore “replaces” chlorine reacts with bromide AND iodide chlorine takes part in two (displacement) reactions bromine reacts with iodide AND does not react with chloride bromine takes part in one (displacement) reactions iodine does not react with chloride or bromide iodine does not take part in any (displacement) reactions	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(a)(i)	fractional distillation		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(a)(ii)	to make it liquid	liquefy/condense to remove water (vapour) to remove carbon dioxide	**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	D weak forces of attraction between the oxygen molecules		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(i)	An description including • shared (electrons) (1) • pair(s) of electrons (between atoms) (1)	Ignore reference to complete/full shells Ignore reference to between two metals Ignore reference to between metal and non-metal Ignore reference to between molecules Any reference to between ions scores 0	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)(ii)	2.4		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(c)(iii)	diagram showing • any shared pair of electrons between a carbon and oxygen atom in CO_2 molecule (1) • rest of molecule correct (1)	Must have O C O arrangement If any atom labelled must be correct Ignore inner electrons even if wrong electrons can be on/in ring or no ring Ignore intersecting circles Accept all permutations of dots and crosses	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(a)	A description including: • add (dilute) (hydrochloric) acid (1) • gas/carbon dioxide (passed into/tested) with limewater (1) • limewater goes milky / cloudy / white ppt (1)	correct formulae heat/thermally decompose bubbled through limewater dependent on use of limewater	**(3)**

Question Number	Answer	Acceptable answers	Mark
3(b)	40 +[2 x 35.5] (=111)	111 alone	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)	• 100 (kg) (calcium carbonate) → 106 (kg) (sodium carbonate) (1) • $\frac{106 \times 40}{100}$ (1) (=42.4)	OR alternative 106÷100 40000÷100 /40÷100 (moles approach) Only 42.4 with no working worth 2 marks 42400**g** worth 2 marks	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(i)	• 10.4/15.0 **(1)** • (10.4/15.0) x100 **(1)** (= 69.3)	69.3 alone worth 2 marks If no/incomplete working shown answer to 2 or more sf scores 2 marks Ignore any units	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)(ii)	Two suggestions from • reaction incomplete (1) • impure reactants (1) • other unwanted/side reaction(s) occur (1) • product lost during experiment/practical (1)	 reversible ignore by-products form could be an example eg some products left in apparatus ignore generic experimental errors eg measuring/weighing errors/human error/spillage	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	C T		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	C Q and S		**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(i)	number of protons (in nucleus of atom)	ignore number of electrons eg number of protons and electrons worth (1)	**(1)**

Question Number	Answer	Acceptable answers	Mark
4(b)(ii)	An explanation including • (atoms of) both contain 5 /same number of protons/same atomic number (1) • boron-10 atoms contain 5 neutrons but boron-11 atoms contain 6 neutrons / different numbers of neutrons/ different mass number (1)	 ignore electrons boron-11 atoms contain 1 more neutron / boron-10 atoms contain 1 less neutron	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(i)	An explanation including the following • M1 {average/mean} mass (of atoms of an element) (1) • M2 compared to {1/12 mass carbon-12 (atom)/ (mass of) carbon-12 (atom) taken as 12} (1)	 For M1 reject weight reject if mass of molecule reject if mass of neutrons and protons any reference to carbon-12 scores mark	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(c)(ii)	[19.7 x 10] (1) +[80.3 x 11] (1) /100 (1) (=10.8) [0.197 x10] (1) + [0.803 x11] (1) = [1.97 + 8.83] (1) (=10.8)	If no working shown 10.8(03) worth 3 marks	**(3)**

Question Number	Answer	Acceptable answers	Mark
5(a)(i)	B lead chloride		**(1)**

Question Number	Answer	Acceptable answers	Mark
5(a)(ii)	An explanation linking two of • strong (electrostatic) forces of attraction • between oppositely charged ions • so requires lot of heat/energy to overcome forces/break bonds	Any reference to molecules/molecular/intermolecular/covalent scores 0 marks strong (ionic) bonds positive and negative ions reject charged atoms for this mark ignore hard to melt/high temperature needed	**(2)**

Question Number	Answer	Acceptable answers	Mark
5(a)(iii)	A description including • M1 add (dilute) nitric acid • M2 add silver nitrate (solution) • M3 forms white ppt/solid	Accept correct formulae If use any other acid can score M2 and M3 dependent on use of silver nitrate Alternative method: Electrolyse (1) Chlorine formed (1) Bleaches litmus/pH paper (1) Ignore smell	**(3)**

Question Number		Indicative Content	Mark
QWC	*** 5(b)**	A description including some of the following points **ion formation** • magnesium atoms lose electrons • each magnesium atom loses two electrons • to acquire full outer shell • magnesium (configuration) becomes 2.8 • forms Mg^{2+} ion • electrons transferred to oxygen atoms • oxygen atoms gain electrons • each oxygen atom gains two electrons • oxygen (configuration) becomes 2.8 • to acquire full outer shell • forms O^{2-} ion **structure** • magnesium ions attract oxide ions • due to opposite charges • ions pack close together • ratio of ions 1: 1 • ions arranged in lattice • giant (ionic) (structure) diagram can be credited for any points	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. magnesium atoms lose electrons and oxygen atoms gain electrons e.g. magnesium oxide is a giant structure • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description e.g. magnesium atoms lose two electrons to form positive ions and oxygen atoms gain two electrons to form negative ions • e.g. magnesium atoms lose electrons and oxygen atoms gain electrons and magnesium oxide is a giant structure • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description e.g. each magnesium atom transfers two electrons to an oxygen atom and the opposite charged ions (Mg^{2+} /O^{2-}) formed attract each other to form a giant (ionic) lattice • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Question Number	Answer	Acceptable answers	Mark
6(a)(i)	$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$ reactants (1) products (1)	Accept multiples If not correctly balanced max 1 Must be subscripts where relevant	**(2)**

Question Number		Indicative Content	Mark
QWC	***6(a)(ii)**	A description including some of the following points **general points** • reactions occur when particles collide • more frequent collisions cause higher rate of reaction • mass and size of zinc pieces same so no effect on rate of reaction • because same surface area • two factors have been altered in the same experiment • cannot be certain of effect of each **concentration** • experiment 2 higher/triple concentration of acid • so more particles (in same volume) • so more frequent collisions between particles • more successful collisions **temperature** • experiment 2 higher temperature • particles move faster • particles have more energy • so more frequent collisions between particles (so increased rate) • more successful collisions • so more energetic collisions between particles • more particles have enough energy to react (activation energy) when they collide	**(6)**
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. temperature is higher and concentration is higher so reaction is faster e.g. temperature is higher so particles move faster so reaction is faster • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	a simple description e.g. temperature is higher so particles move faster and concentration is higher so more particles so reaction is faster eg when concentration is higher there will be more particles so more frequent collisions so faster reaction e.g. when temperature is higher particles move faster so more successful collisions so faster reaction • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology	

		appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed description e.g. higher concentration of acid so more particles so more frequent collisions so faster reaction and higher temperature so particles have more energy so more successful collisions so faster reaction • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Question Number	Answer	Acceptable answers	Mark
6(b)(i)	B displacement		**(1)**

Question Number	Answer	Acceptable answers	Mark
6(b)(ii)	Shown on diagram • horizontal reactant line above product line (1) • horizontal product line to right of reactant line (1)	lines must be correctly labelled eg reactants/Zn + $CuSO_4$ and products/ $CuSO_4$ and Cu ignore any extra lines/curves/labels if not drawn lines but just labels in correct relative positions max 1 If two lines drawn in correct positions but no labels max 1	**(2)**

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