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Mark Scheme (Results)

January 2015

Pearson Edexcel International GCSE in Chemistry (4CH0) Paper 2C

Pearson Edexcel Certificate in Chemistry (4CH0) Paper 2C

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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.
- 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.

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Question number	Answer	Accept	Reject	Marks
1 (a)	D (a molecule)			1
(b)	A (covalent)			1
(c)	NH_3	H_3N		1

Total 3 marks

Question number	Answer	Accept	Reject	Marks
2 (a) (i)	(solubility/it) increases as temperature increases	positive correlation	references to proportionality	1
(ii)	(solid) B			1
(b)	**M1** – solid/crystals would form	precipitate for solid goes cloudy		1
	M2 – (solid A) becomes less soluble (as the solution cools) / solubility (of solid A) decreases (as temperature decreases)	reverse argument		1

Total 4 marks

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<table>
<tr><th>Question number</th><th>Expected Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>3 (a)</td><td>M1 P – iron ore / haematite
ignore iron(III) oxide/Fe_2O_3

M2 Q - calcium silicate</td><td>

slag / $CaSiO_3$</td><td></td><td>2</td></tr>
<tr><td>(b)</td><td><table><tr><th>Type of reaction</th><th>Letter</th></tr><tr><td>one that gives out heat</td><td>A</td></tr><tr><td>one that is a thermal decomposition</td><td>D ;</td></tr><tr><td>one that is a neutralisation</td><td>E ;</td></tr><tr><td>one that forms a poisonous gas</td><td>B ;</td></tr></table></td><td></td><td></td><td>3</td></tr>
<tr><td>(c)</td><td>M1- oxygen

IGNORE O

M2 – water</td><td>air

O_2

moisture/H_2O</td><td></td><td>2</td></tr>
</table>

(d)	**M1** zinc corrodes/reacts instead of iron / faster than iron **M2** iron corrodes/reacts instead of tin / faster than tin lack of comparison with other metal max 1 from **M1** and **M2** ignore references to tin rusting **M3** correct reference to order of reactivity of all three metals	zinc loses electrons/is oxidised instead of iron iron loses electrons/is oxidised instead of tin accept reverse arguments	zinc rusts (instead of iron)	3

Total 10 marks

Question number	Answer	Accept	Reject	Marks
4(a)(i)	fermentation			1
(ii)	(to provide the) catalyst/enzyme/zymase	to increase the rate of the reaction		1
(b)(i)	**M1** (test) – flame test **M2** (observation) – brick red / orange-red	suitable description of flame test red		2
(ii)	copper(II) ions: **M1** (test) – (aqueous) sodium hydroxide / NaOH **M2** (observation) – blue precipitate ignore shades of blue **M2** dep on **M1** or near miss of formula, eg $Na(OH)_2$ sulfate ions: **M1** (test) – (dilute) hydrochloric acid / HCl **M2** (test) - (aqueous) barium chloride / $BaCl_2$ **M3** (observation) – white precipitate **M3** dep on **M2** or near miss	accept other suitable alkalis suitable alternatives to precipitate (dilute) nitric acid / HNO_3 (aqueous) barium nitrate / $Ba(NO_3)_2$	all other colours Reject sulfuric acid for **M1** only	5

Question number	Answer	Accept	Reject	Marks
4 (c)	**M1** (pressure) – 60-70 atm **M2** (catalyst) – phosphoric acid / H_3PO_4 ignore references to concentration	any pressure or range within this range phosphoric(V) acid	 any other oxidation state	2
(d)	**M1** (Σ bonds broken) 348 + 412 + 360 (= 1120) **M2** (Σ bonds made) 612 + 463 (= 1075) **M3** **M1** – **M2** / **Σ** bonds broken – Σ bonds made **M4** (+)45 (kJ/mol) Correct answer with no working scores 4 **– 45 (kJ/mol) scores 3**	3231 3186		4

Total 15 marks

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Question number	Answer	Accept	Reject	Marks
5 (a)	**M1** temperature after: 27.1 **M2** temperature before: 18.8 **M3** temperature change: (+) 8.3 Recorded temperatures correct but in wrong order scores 1 for **M1** and **M2** **M3** csq on **M1** and **M2**	one trailing zero	more than one trailing zero	3
(b)	**M1** heat (energy) /thermal energy lost (to the atmosphere) ignore just energy lost **M2** potassium hydroxide dissolves (very/too) slowly	water evaporates potassium hydroxide does not completely dissolve potassium hydroxide is impure less than 3 g of potassium hydroxide is used more than 50 cm^3 of water is used		2

Total 5 marks

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<table>
<tr><th>Question number</th><th>Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>6 (a)</td><td>
<table>
<tr><th>Element</th><th>Arrangement of electrons in atom</th><th>Arrangement of electrons in ion</th><th>Charge on ion</th></tr>
<tr><td></td><td></td><td>2.8.8</td><td>(1)+/+1</td></tr>
<tr><td></td><td></td><td>2.8.8</td><td>2−/−2</td></tr>
</table>
M1 – <u>both</u> arrangements correct
M2 – charge on potassium ion
M3 – charge on sulfide ion</td><td>$K^{(1)+}$ / K^{+1}
S^{2-} / S^{-2}
positive for potassium and negative for sulfide for 1 mark</td><td></td><td>3</td></tr>
<tr><td>(b) (i)</td><td><u>ions</u> move/travel (to the electrodes)</td><td><u>ions</u> are free to move / <u>ions</u> are mobile</td><td>electrons free to move</td><td>1</td></tr>
<tr><td>(ii)</td><td>M1 (electrostatic) forces (of attraction) between (oppositely charged) <u>ions</u>
M2 are (relatively) strong
M3 large amount of energy required to overcome the forces / separate the ions from the lattice
M2 dep on mention of forces (of attraction) or bonds
Mention of covalent bonds or intermolecular forces no M1</td><td><u>ionic</u> bonding / <u>ionic</u> bonds
break the bonds</td><td></td><td>3</td></tr>
</table>

Total 7 marks

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Question number	Answer	Accept	Reject	Marks
7 (a)	$H_2S_2O_7$ + H_2O → $2H_2SO_4$	multiples and fractions		1
(b)	**M1** 32 (of S) → 80 (of SO_3) (tonnes or g) **M2** mass of SO_3 = $\frac{80}{32} \times 80$ **M3** = 200 (tonnes) **M2 csq on M1** **M3 csq on M2** Correct answer with no working scores 3	**M1** n(S) = (n(SO_3)) = $\frac{80 \text{ x } 10^6}{32}$(mol) (= 2 500 000 (mol)) **M2** mass of SO_3 = **M1 x 80 (= 200 000 000 (g))** **M3** = **M2** ÷ 10^6 / 200 (tonnes)		3
(c)	**M1** 64 (g) (of SO_2) reacts with 12 (dm^3) (of O_2) **M2** (64 tonnes) reacts 12 x 10^6 (dm^3) OR 1.2 x 10^7 (dm^3) **M2** csq on **M1** Correct answer with no working scores 2	**M1** n(SO_2) = $\frac{64 \text{ x } 10^6}{64}$ (mol) (= 10^6 mol) **M2** $\frac{\textbf{M1}}{2}$ x 24 / 1.2 x 10^7 (dm^3) OR **M1** mass of oxygen accept 1.2 x 10^{10} <u>cm^3</u>		2

Total 6 marks

Question number	Answer	Accept	Reject	Marks
8	**M1** – add (aqueous) chlorine to (aqueous) KBr **M2** – (solution) turns orange **M3** – add (aqueous) bromine to (aqueous) KI **M4** - (solution) turns brown **M5** – $Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$ OR $Br_2 + 2KI \rightarrow I_2 + 2KBr$ Ignore state symbols	yellow / brown red-brown / orange correct ionic equations accept $Cl_2 + 2KI \rightarrow I_2 + 2KCl$ if chlorine is added to potassium iodide	red yellow	5

Total 5 marks

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Question number	Answer	Accept	Reject	Marks
8	**M1** – add (aqueous) bromine to (aqueous) KCl **M2** – no change **M3** – add (aqueous) iodine to (aqueous) KBr **M4** - no change / no change If this route is chosen then **M5** cannot be scored	orange / yellow / brown solution/colour produced only if it is clear that no reaction has occurred brown / red-brown / orange solution/colour produced only if it is clear that no reaction has occurred	red yellow	5

Total 5 marks

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Question number	Answer	Accept	Reject	Marks
9 (a)(i)	shifts to left	moves in the endothermic direction shifts to the side of the reactants OWTTE		1
(ii)	shifts to the right	moves in the exothermic direction shifts to the side of the products OWTTE shifts to the side with fewer (gas) moles/molecules		1 1
(iii)	impossible to know which shift is greater / impossible to know which change has the greater effect	OWTTE the (two) effects are opposing one another		
(b)	**M1** – greater proportion of NO_2 **M2** – (increase of) temperature has a greater effect than (increase of) pressure	more NO_2 present equilibrium shifts to left		2

Total 5 marks

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