



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.

Question number	Answer	Accept	Reject	Marks
1 (a)	D (a molecule)			1
(b)	A (covalent)			1
(c)	NH ₃	H ₃ N		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

Question number	Expected Answer	Accept	Reject	Marks										
3 (a)	M1 P – iron ore / haematite ignore iron(III) oxide/ Fe_2O_3 M2 Q - calcium silicate	slag / CaSiO_3		2										
(b)	<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>	Type of reaction	Letter	one that gives out heat	A	one that is a thermal decomposition	D ;	one that is a neutralisation	E ;	one that forms a poisonous gas	B ;			3
Type of reaction	Letter													
one that gives out heat	A													
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one that is a neutralisation	E ;													
one that forms a poisonous gas	B ;													
(c)	M1 - oxygen IGNORE O M2 – water	air O_2 moisture/ H_2O		2										

(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
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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	suitable description of flame test		2
(ii)	M2 (observation) – brick red / orange-red	red		5
	copper(II) ions:	accept other suitable alkalis		
	M1 (test) – (aqueous) sodium hydroxide / NaOH	suitable alternatives to precipitate		
	M2 (observation) – blue precipitate ignore shades of blue		all other colours	
	M2 dep on M1 or near miss of formula, eg Na(OH) ₂			
	sulfate ions:	(dilute) nitric acid / HNO ₃		
	M1 (test) – (dilute) hydrochloric acid / HCl	(aqueous) barium nitrate / Ba(NO ₃) ₂	Reject sulfuric acid for M1 only	
	M2 (test) - (aqueous) barium chloride / BaCl ₂			
	M3 (observation) – white precipitate			
	M3 dep on M2 or near miss			

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

Question number	Answer		Accept	Reject	Marks
5 (a)	M1 temperature after	27.1	one trailing zero	more than one trailing zero	3
	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				
(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

Question number	Answer				Accept	Reject	Marks	
6 (a)	Element	Arrangement of electrons in atom	Arrangement of electrons in ion	Charge on ion	$K^{(1)+} / K^{+1}$ S^{2-} / S^{-2} positive for potassium and negative for sulfide for 1 mark		3	
			2.8.8	(1)+ / +1				
			2.8.8	2- / -2				
	M1 – <u>both</u> arrangements correct							
	M2 – charge on potassium ion							
	M3 – charge on sulfide ion							
(b) (i)	<u>ions</u> move/travel (to the electrodes)				<u>ions</u> are free to move / <u>ions</u> are mobile	electrons free to move	1	
	(ii)	M1 (electrostatic) forces (of attraction) between (oppositely charged) <u>ions</u>						<u>ionic</u> bonding / <u>ionic</u> bonds
		M2 are (relatively) strong						break the bonds
		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						3	

Total 7 marks

Question number	Answer	Accept	Reject	Marks
7 (a)	$\text{H}_2\text{S}_2\text{O}_7 + \text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4$	multiples and fractions		1
(b)	M1 32 (of S) $\rightarrow$ 80 (of SO_3) (tonnes or g) M2 mass of $\text{SO}_3 = \frac{80}{32} \times 80$ M3 = 200 (tonnes) M2 csq on M1 M3 csq on M2 Correct answer with no working scores 3	M1 $n(\text{S}) = (n(\text{SO}_3)) = \frac{80 \times 10^6}{32} (\text{mol}) (= 2\,500\,000 (\text{mol}))$ M2 mass of $\text{SO}_3 = \mathbf{M1 \times 80 (= 200\,000\,000 (g))}$ M3 = M2 $\div 10^6 / 200$ (tonnes)		3
(c)	M1 64 (g) (of SO_2) reacts with 12 (dm^3) (of O_2) M2 (64 tonnes) reacts $12 \times 10^6 (\text{dm}^3)$ OR $1.2 \times 10^7 (\text{dm}^3)$ M2 csq on M1 Correct answer with no working scores 2	M1 $n(\text{SO}_2) = \frac{64 \times 10^6}{64} (\text{mol}) (= 10^6 \text{ mol})$ M2 $\frac{\mathbf{M1}}{2} \times 24 / 1.2 \times 10^7 (\text{dm}^3)$ OR M1 mass of oxygen accept $1.2 \times 10^{10} \underline{\text{cm}^3}$		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 – $\text{Cl}_2 + 2\text{KBr} \rightarrow \text{Br}_2 + 2\text{KCl}$ OR $\text{Br}_2 + 2\text{KI} \rightarrow \text{I}_2 + 2\text{KBr}$ Ignore state symbols	yellow / brown red-brown / orange correct ionic equations accept $\text{Cl}_2 + 2\text{KI} \rightarrow \text{I}_2 + 2\text{KCl}$ if chlorine is added to potassium iodide	red yellow	5

Total 5 marks

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

Question number	Answer	Accept	Reject	Marks
9 (a)(i)	shifts to left	moves in the endothermic direction		1
(ii)	shifts to the right	shifts to the side of the reactants OWTTE		1
(iii)	impossible to know which shift is greater / impossible to know which change has the greater effect	moves in the exothermic direction shifts to the side of the products OWTTE shifts to the side with fewer (gas) moles/molecules OWTTE the (two) effects are opposing one another		1
(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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