Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCE AS Level
In Chemistry (8CH0)
Paper 01: Core Inorganic and Physical Chemistry

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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.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate.

Using the Mark Scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication
Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of 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.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Question Number	Answer	Mark
1	**The only correct answer is B** ($1s^2 2s^2 2p^6 3s^2 3p^6$) ***A*** *is incorrect because this is the electronic configuration of a phosphorus atom* ***C*** *is incorrect because this would be the electronic configuration of a* P^{3+} *ion* ***D*** *is incorrect because this electronic configuration is missing the 3s orbital*	**(1)**

(Total for Question 1 = 1 mark)

Question Number	Answer	Mark
2	**The only correct answer is D** (1086 2353 4621 6223) ***A*** *is incorrect because there is a large increase between the* 1^{st} *and* 2^{nd} *ionisation energies, indicating a Group 1 element* ***B*** *is incorrect because there is a large increase between the* 2^{nd} *and* 3^{rd} *ionisation energies, indicating a Group 2 element* ***C*** *is incorrect because there is a large increase between the* 3^{rd} *and* 4^{th} *ionisation energies, indicating a Group 3 element*	**(1)**

(Total for Question 2 = 1 mark)

Question Number	Answer	Mark
3	**The only correct answer is D** (decreasing, increasing) ***A*** *is incorrect because atomic radii decrease across Period 2* ***B*** *is incorrect because atomic radii decrease across Period 2 and increase down Group 2* ***C*** *is incorrect because atomic radii increase down Group 2*	**(1)**

(Total for Question 3 = 1 mark)

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)(i)	An answer that makes reference to the following points: • (KCl forms a) white precipitate **(1)** • (KBr forms an) off-white / cream / pale yellow precipitate **(1)** • (KI forms a) yellow precipitate **(1)**	Allow ppte / ppt / solid / crystals for precipitate Penalise lack of 'precipitate' once only Penalise incorrect initial colour once only	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)(ii)	An answer that makes reference to the following points: • (AgCl) (white) precipitate dissolves in dilute (and concentrated aqueous) ammonia **(1)** • (AgBr) (cream / off-white) precipitate does not dissolve in dilute aqueous ammonia solution but dissolves in concentrated (aqueous) ammonia **(1)** • (AgI) (yellow) precipitate does not dissolve in dilute or concentrated (aqueous) ammonia **(1)**	Allow AgBr only dissolves in concentrated ammonia solution Allow AgI does not dissolve	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)(i)	An answer that makes reference to the following point: • white **and** precipitate forms or brown **and** precipitate forms	Allow ppte / ppt / solid / crystals for precipitate Allow insoluble for precipitate. Do not award any additional incorrect observations e.g. bubbles Ignore incorrect formulae	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)(ii)	An answer that makes reference to the following point: • bubbles (of carbon dioxide)	Accept effervescence / fizzing Ignore just gas given off which turns limewater cloudy Do not award any additional incorrect observations e.g. cloudy solution Do not award incorrect gas identified	**(1)**

Question Number	Acceptable Answer		Additional Guidance	Mark
4(b)(iii)			<u>Example of ionic equation</u>	**(2)**
	• correct species and balancing	**(1)**	$2H^+(aq) + CO_3^{2-}(aq) \rightarrow CO_2(g) + H_2O(l)$	
	• state symbols	**(1)**	Allow state symbols for near miss equation e.g. non ionic equation	

(Total for Question 4 = 10 marks)

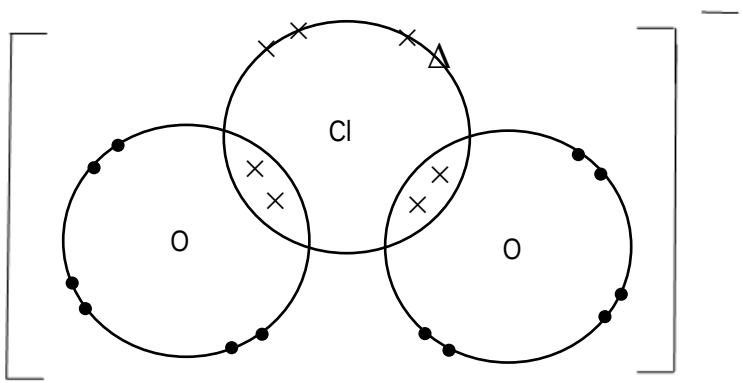
Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)	An answer that makes reference to the following points: • use a fume cupboard **(1)** • gloves **(1)**	Allow an answer that recognises the problem of a toxic gas Allow fume hood/box Ignore use of mask, respirator, breathing equipment (or anything that uses all/part of the available air). Allow an answer that recognises the problem of skin absorption Ignore type of glove (nitrile, plastic, gauntlet etc.)	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)		<u>Example of calculation</u>	**(4)**
	• molar mass of chlorine dioxide **(1)**	67.5 (g mol^{-1})	
	• moles of chlorine dioxide **(1)**	5.40 ÷ 67.5 = 0.08 / 0.080 (mol)	
	• moles of $NaClO_2$ required **(1)**	5 ÷ 4 × 0.08(0) = 0.1 / 0.10 (mol)	
	• molar mass of $NaClO_2$ **and** calculation of mass of $NaClO_2$ **(1)**	90.5 **and** 90.5 × 0.1 = 9.05 / 9.1 (g) Ignore SF except 1 SF in final answer only TE at each stage	

Question Number	Acceptable Answer		Additional Guidance	Mark
5(c)(i)	**EITHER** • calculation of increase in moles of gas • convert increase in moles of gas to volume (cm^3) **OR** • calculation of product volume • calculation of reactant volume and increase	**(1)** **(1)** **(1)** **(1)**	<u>Example of calculation</u> $0.125 \times 0.5 = 0.0625$ (mol) $0.0625 \times 24\,000 = 1500$ (cm^3) $0.125 \times 1.5 = 0.1875$ $0.1875 \times 24\,000 = 4500$ (cm^3) $0.125 \times 24\,000 = 3000$ (cm^3) $4500 - 3000 = 1500$ (cm^3) Ignore SF except 1 SF	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(c)(ii)	• calculation of moles of Cl_2 **(1)** • calculation of moles of ClO_2 **(1)** • calculation of mass of ClO_2 to 2 or 3 SF **(1)**	Example of calculation $(7.82 \times 10^{-8} \times 400) \times 1000 = 0.03128$ $0.03128 \times 2 = 0.06256$ $0.06256 \times 67.5 = 4.2228$ $= 4.2 / 4.22$ (g) Allow alternative method for M1, M2 and M3: M1 concentration of ClO_2 ($= 7.82 \times 10^{-8}$ mol $dm^{-3} \times 2$) moles of ClO_2 in 1 dm^3 ($= 1.564 \times 10^{-7}$ mol) M2 mass of ClO_2 in 1 dm^3 ($= 1.564 \times 10^{-7} \times 67.5$ $= 1.0557 \times 10^{-5}$ g M3 mass in 400 $\mathbf{m^3}$ ($= 1.0557 \times 10^{-5} \times 400000$) g = 4.22/4.2 g TE at each stage except for a final answer/M3 of a mass greater than 4220g	**(3)**

Question Number	Answer	Mark
5(d)	**The only correct answer is D** (permanent dipoles) ***A*** *is not correct because there are no covalent bonds between molecules* ***B*** *is not correct because this molecule does not contain hydrogen so there are no hydrogen bonds between molecules* ***C*** *is not correct because there are no ionic bonds between molecules*	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(e)(i)	An explanation that makes reference to the following points: • 8 electrons around both oxygen atoms including 6 dots and 2 other electron symbols **(1)** • 8, 10 or 12 electrons around the chlorine atom including 7 crosses and 1, 3 or 5 other electron symbols respectively **(1)**	 10 electrons around the chlorine result from 1 Cl=O 12 electrons around the chlorine result from 2 Cl=O Do not allow the triangle electron to be placed as a bonded electron between the chlorine and oxygen	**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(e)(ii)	An explanation that makes reference to the following points: • predicted bond angle = 104.5 (°) **(1)** • 4 pairs of electrons around the chlorine suggests a tetrahedral shape / bond angle 109.5 (°) **(1)** • however lone pair repulsion greater (than bond pair repulsion so angle reduced) **(1)**	Ignore shape even if incorrect Allow answers that mention 4 pairs of electrons arranged to minimise repulsion Do not award repulsion of atoms Ignore just 'lone pairs reduce bond angle' Allow reference to molecular shape rather than ion	**(3)**

Question Number	Answer	Mark
5(f)	**The only correct answer is C** (−2) ***A*** *is not correct because −1 is the overall charge on the chlorate (III) ion* ***B*** *is not correct because +1 is not a possible oxidation state for oxygen in this substance* ***D*** *is not correct because +2 is present in* OF_2*. And O is more electronegative than Cl, so O is assigned a negative oxidation number*	**(1)**

(Total for Question 5 = 18 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
6(a)(i)	• percentage of oxygen **(1)** • conversion of % to moles **(1)** • divide smallest into the others to get a ratio **and** empirical formula **(1)**	Example of calculation 100 – 26.7 – 2.2 = 71.1% Allow 71% C 26.7 ÷ 12 = 2.225 H 2.2 ÷ 1 = 2.2 O 71.1 ÷ 16 = 4.444 2.225 ÷ 2.2 = 1 2.2 ÷ 2.2 = 1 4.444 ÷ 2.2 = 2 CO_2H Allow elements in any order No TE	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(a)(ii)	• relative atomic mass (90) ÷ empirical mass (45) **and** molecular formula ($C_2O_4H_2$)	Example of calculation $CO_2H = 45$ 90 ÷ 45 = 2 and $2 \times CO_2H = C_2O_4H_2$ Correct answer with no working scores (1)	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(b)	• correct calculation **(1)** • relative atomic mass **and** final answer corrected to 2 DP **(1)**	Example of calculation $\frac{(50 \times 4.31) + (52 \times 83.76) + (53 \times 9.55) + (54 \times 2.38)}{100}$ = 52.0569 = 52.06 Correct final answer with no working scores (2) Allow TE If units given, allow g mol^{-1} / AMU units only	**(2)**

Question Number	Answer	Mark
6(c)	**The only correct answer is C** (p = 12 , n = 12, e = 10) ***A*** *is not correct because the number of electrons and the number of protons is the same, so this is a neutral atom* ***B*** *is not correct because the number of electrons and the number of protons is the same, so this is a neutral atom* ***D*** *is not correct because the number of electrons exceeds the number of protons, so this is an anion*	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(d)	An answer that makes reference to the following point: • relative molecular mass = 114	 Ignore units, even if incorrect	**(1)**

(Total for Question 6 = 8 marks)

<table>
<tr><th>Question Number</th><th>Acceptable Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr>
<td>7(a)*</td>
<td>An answer that makes reference to the following points:
This question assesses a student's ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning.
Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.
The following table shows how the marks should be awarded for indicative content.
<table>
<tr><th>Number of indicative marking points seen in answer</th><th>Number of marks awarded for indicative marking points</th></tr>
<tr><td>6</td><td>4</td></tr>
<tr><td>5-4</td><td>3</td></tr>
<tr><td>3-2</td><td>2</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td></tr>
</table>
The following table shows how the marks should be awarded for structure and lines of reasoning.
<table>
<tr><th></th><th>Number of marks awarded for structure and sustained lines of reasoning</th></tr>
<tr><td>Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout.</td><td>2</td></tr>
<tr><td>Answer is partially structured with some linkages and lines of reasoning.</td><td>1</td></tr>
<tr><td>Answer has no linkages between points and is unstructured.</td><td>0</td></tr>
</table>
</td>
<td>Guidance on how the mark scheme should be applied:

The mark for indicative content should be added to the mark for lines of reasoning. For example, an answer with five indicative marking points that is partially structured with some linkages and lines of reasoning, scores 4 marks (3 marks for indicative content and 1 mark for partial structure and some linkages and lines of reasoning).

If there are no linkages between points, the same five indicative marking points would yield an overall score of 3 marks (3 marks for indicative content and no marks for linkages).

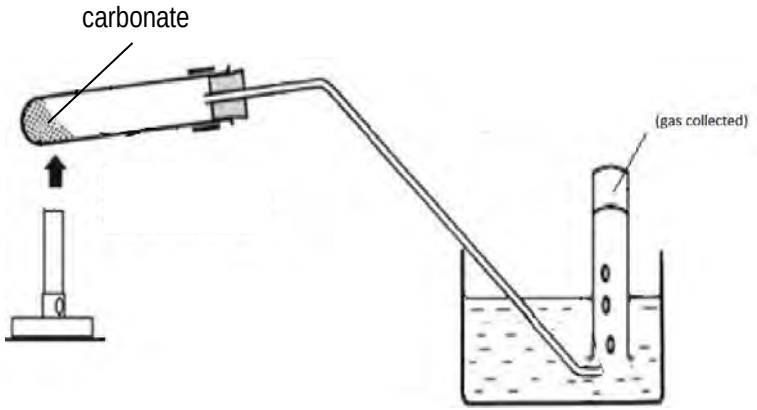
In general it would be expected that 5 or 6 indicative points would get 2 reasoning marks, and 3 or 4 indicative points would get 1 mark for reasoning, and 0, 1 or 2 indicative points would score zero marks for reasoning.

If there is any incorrect chemistry, deduct mark(s) from the reasoning. If no reasoning mark(s) awarded do not deduct mark(s).</td>
<td>(6)</td>
</tr>
</table>

	Indicative content: • **IP1** potassium chloride (and bromide) produces misty / steamy fumes (of hydrogen halide) • **IP2** equation for reaction between potassium chloride + concentrated sulfuric acid • **IP3** brown fumes of bromine • **IP4** equation for HBr producing SO_2 and Br_2 • **IP5** no change in oxidation numbers of (potassium) chloride / sulfur • **IP6** with (potassium) bromide the sulfur is reduced to +4 (therefore the stronger reducing agent)	Ignore states in equations even if incorrect Allow white fumes Ignore identification of the fumes using ammonia Do not award white smoke for misty fumes $KCl + H_2SO_4 \rightarrow KHSO_4 + HCl$ Allow $2KCl + H_2SO_4 \rightarrow K_2SO_4 + 2HCl$ Allow ions given in equation for KCl Allow orange / orange-brown fumes of bromine Allow orange/ brown liquid of bromine Do not award yellow fumes Do not award reference to 'eggy smell' / yellow solid of sulfur $2HBr + H_2SO_4 \rightarrow Br_2 + SO_2 + 2H_2O$ $2KBr + 2H_2SO_4 \rightarrow Br_2 + SO_2 + 2H_2O + K_2SO_4$ Allow ions given in equation for KBr or HBr Ignore any explanations or justifications, even if incorrect	

Question Number	Acceptable Answer	Additional Guidance	Mark
7(b)(i)	An answer that makes reference to the following point: • **chlorides** are more volatile (than other compounds).	Allow converse argument; compounds formed by other acids are less volatile Allow 'chlorides are more easily vaporised' Allow 'it forms a volatile (metal) chloride (from the salt)' Do not award hydrochloric acid is more volatile	**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(b)(ii)	An answer that makes reference to the following point: • potassium (ion) / $K^{(+)}$		(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
7(c)(i)	An answer that makes reference to the following points: • heating carbonate in suitable container, eg test tube **(1)** • collection of gas produced eg by syringe, gas burette, inverted test tube / measuring cylinder etc **(1)** OR Alternative method: **(1)** • M2 bubble gas through lime water. time how long for lime water to go milky	<u>Example of suitable diagram</u>  Do not award M1 for conical flask/ beaker Do not award M1 if additional reagents are in the container Do not award M2 if gas syringe does not have plunger Do not award M2 if the apparatus would not work e.g. no bung or gas cannot move through the apparatus	(2)

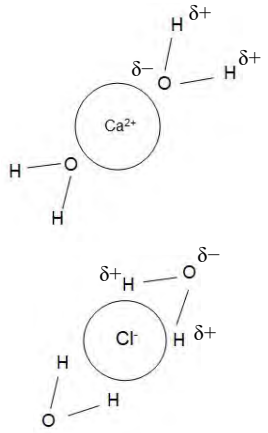
Question Number	Acceptable Answer	Additional Guidance	Mark
7(c)(ii)	An answer that makes reference to any two of the following points • same Bunsen flame / same Bunsen temperature **(1)** • same distance of heat source from test tube **(1)** • allow same moles of each carbonate **(1)**	Ignore just same temperature / heat Allow same Bunsen setting Accept 'amount' of each carbonate Do not award same mass / volume Do not award heat under reflux for either M1 or M2	**(2)**

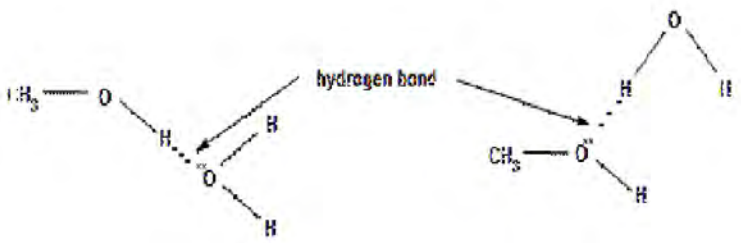
Question Number	Acceptable Answer	Additional Guidance	Mark
7(c)(iii)	An answer that makes reference to the following point: **either** • measure the time taken for lime water to turn milky **or** • measure the time taken for a particular volume of gas collected		**(1)**

Question Number	Answer	Mark
7(c)(iv)	**The only correct answer is C** (carbonates: increasing, nitrates: increasing) ***A*** *is incorrect because the thermal stability of nitrates increases down the Group 2* ***B*** *is incorrect because the thermal stability of nitrates increases down the Group 2* ***D*** *is incorrect because the thermal stability of carbonates increases down the Group 2*	**(1)**

Question Number	Acceptable Answer		Additional Guidance	Mark
7(d)	An explanation that makes reference to the following points:			**(4)**
	• solid potassium chloride is a poor conductor because the ions are in fixed positions	**(1)**	Allow just 'the ions are not mobile' Allow lattice for fixed position	
	• liquid potassium chloride conducts because the ions are free to move	**(1)**	Allow delocalised ions for ions are free to move	
	• iron is a good conductor when solid or liquid because it has delocalised electrons (which move and carry charge)	**(1)**	Allow electrons that are free to move for delocalised electrons	
	• water is a poor conductor because there are no charge carriers / electrons that are free to move/ ions that are free to move	**(1)**	Allow very few ions in pure water Do not award marking points if incorrect bonding referred to	

(Total for Question 7 = 18 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
8(a)(i)	An explanation that makes reference to the following points: • diagram of Ca^{2+} surrounded by water molecules (any number > 1) **(1)** • diagram of Cl^- surrounded by water molecules (any number > 1) **(1)** • dipoles shown on at least one water molecule in each case **(1)** • energy / strength of new interactions between solute and solvent is approximately the same as (the sum of) the energy / strength of the interactions between the solute particles and solvent particles **(1)**	 Penalise one water molecule on each ion once only Penalise incorrect ion / ion charge once only Do not award if water molecule shown as ions Energy from making bonds / bond strength between water and ions compensates for / is greater than the energy needed to break bonds in water / solvent and calcium chloride / solute / lattice	**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(a)(ii)	An explanation that makes reference to the following points: • hydrogen bonding occurs between methanol and water molecules. **(1)** • labelled diagram of hydrogen bonding including a least one lone pair on the relevant oxygen (max 2 lone pairs on any O atom) **(1)** • labelled diagram of hydrogen bonding including bond angle O−H−O = approximately180º (visual assessment is adequate) **(1)**	 Allow either or both diagrams. minimum = 3 dashes/dots Hydrogen bond must be identified for M2 and M3. Penalise once only Penalise incorrect structure of methanol / water once only for M2/M3 If two or more hydrogen bonds are shown then both or all must be correct to score M2 and M3.	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)(i)	An explanation that makes reference to the following points: • 2,2-dimethylpropane has two branches **(1)** • Contact/surface area for 2,2-dimethylpropane is much smaller than for pentane **(1)** • London/van der Waals/ instantaneous dipole/temporary dipole/fluctuating dipole forces/ dispersion forces etc are smaller/weaker in 2,2-dimethylpropane (and therefore a lower boiling temperature) **(1)**	Allow reverse argument throughout e.g. pentane has no branches for M1 Allow is branched Allow pentane has a longer chain length Do not award if reference to different number of electrons Do not award if reference to covalent bonds breaking	**(3)**

Question Number	Acceptable Answer		Additional Guidance	Mark
8(b)(ii)	An explanation that makes reference to the following points:			(4)
	• identification of structure of silicon ((IV)) oxide / SiO_2	(1)	Silicon ((IV)) oxide is a giant (covalent) structure / lattice (of atoms) Allow reference to silicon dioxide Do not award reference to silicon ((IV)) oxide molecules or double bonds	
	• identification of structure of silicon tetrachloride / $SiCl_4$	(1)	Silicon tetrachloride is simple molecular	
	• SiO_2 has strong covalent bonds which have to be broken therefore require high amounts of energy	(1)	Penalise lack of amount of energy needed once only in M3 and M4	
	• $SiCl_4$ only has to break weak London forces therefore lower amounts of energy	(1)	Allow van der Waals'/dispersion forces / instantaneous dipole – induced dipole for London forces	

(Total for Question 8 = 14 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
9(a)	• balanced equation	Example of equation $2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$ Ignore state symbols even if incorrect Inclusion of electron scores 0	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
9(b)(i)	An answer that makes reference to the following point: • a single species is not oxidised and reduced or two different species are not oxidised and reduced (to form the same species)	Allow reaction identified as 'reverse disproportionation' / comproportionation Allow ions for species Ignore one species is oxidised and one species is reduced	(1)

Question Number	Acceptable Answer	Additional Guidance	Mark
9(b)(ii)	An answer that makes reference to the following point: • (reducing agent is the) chloride ion / Cl^-		(1)

Question Number	Answer	Mark
9(b)(iii)	**The only correct answer is C** ($ClO^- + 2H^+ + e^- \rightarrow ½Cl_2 + H_2O$) ***A*** *is not correct because this equation shows both oxidant and reductant* ***B*** *is not correct because this equation produces hydroxide ions which would not be possible in acid conditions* ***D*** *is not correct because oxygen is not a product of the overall reaction*	**(1)**

Question Number	Acceptable Answer		Additional Guidance	Mark
9(c)			Example of calculation	(5)
	• moles of $KClO_3$	**(1)**	= 5.00 ÷ 122.6 = 0.040783 Allow this as a fraction (25/613)	
	• moles of oxygen	**(1)**	Moles oxygen = moles $KClO_3$ × 1.5 = 0.061175 Allow this as a fraction (75/1226)	
	• conversion of temp °C to K	**(1)**	30 + 273 = 303 K Allow shown as figure (303) used in equation	
	• rearrangement of ideal gas equation and substitute figures	**(1)**	$V = \frac{nRT}{p} = \frac{0.061175 \times 8.31 \times 303}{110\,000}$	
	• evaluation and conversion to cm^3	**(1)**	= 1.400302 × 10^{-3} (m^3) = 1400 (cm^3) Allow TE throughout Ignore SF except one for M5 only Correct final answer with no working scores (5)	

(Total for Question 9 = 9 marks)

TOTAL FOR PAPER = 80 MARKS