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# **Mark Scheme (Results)**

October 2017

Pearson Edexcel International  
Advanced Level In Chemistry (WCH02)  
Paper 01 Application Of Core Principles  
Of Chemistry

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October 2017

Publications Code WCH02\_01\_1710\_MS

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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.

**Section A**

Question Number	Correct Answer	Mark
<b>1</b>	<p><b>1. The only correct answer is D</b></p> <p><i>A is not correct because not Ionic</i></p> <p><i>B is not correct because not Ionic</i></p> <p><i>C is not correct because smaller cation, larger anion</i></p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>2</b>	<p><b>2. The only correct answer is C</b></p> <p><i>A is not correct because trigonal planar</i></p> <p><i>B is not correct because trigonal planar</i></p> <p><i>D is not correct because trigonal planar</i></p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>3</b>	<p><b>3. The only correct answer is C</b></p> <p><i>A is not correct because no dative covalent bond</i></p> <p><i>B is not correct because no dative covalent bond</i></p> <p><i>D is not correct because no dative covalent bond</i></p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>4</b>	<p><b>4. The only correct answer is D</b></p> <p><i>A is not correct because non-polar molecule</i></p> <p><i>B is not correct because non-polar molecule</i></p> <p><i>C is not correct because non-polar molecule</i></p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>5</b>	<p><b>5. The only correct answer is C</b></p> <p><i>A is not correct because only London forces</i></p> <p><i>B is not correct because only London forces</i></p> <p><i>D is not correct because only London forces</i></p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>6</b>	<b>6. The only correct answer is D</b> <i>A is not correct because only hexagonal rings</i> <i>B is not correct because no pentagonal rings</i> <i>C is not correct because no pentagonal rings</i>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>7</b>	<b>7. The only correct answer is D</b> <i>A is not correct because linear</i> <i>B is not correct because tetrahedral</i> <i>C is not correct because tetrahedral</i>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>8</b>	<b>8. The only correct answer is B</b> <i>A is not correct because brick red flame</i> <i>C is not correct because brick red flame</i> <i>D is not correct because neutral solution</i>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>9</b>	<b>9. The only correct answer is A</b> <i>B is not correct because it increases</i> <i>C is not correct because it decreases</i> <i>D is not correct because it remains the same</i>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>10</b>	<b>10. The only correct answer is A</b> <i>B is not correct because not the most soluble</i> <i>C is not correct because not the most soluble</i> <i>D is not correct because not the most soluble</i>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>11</b>	<p><b>11. The only correct answer is A</b></p> <p><b>B</b> is not correct because bond energies decrease down the group</p> <p><b>C</b> is not correct because bond energies decrease down the group</p> <p><b>D</b> is not correct because bond energies decrease down the group</p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>12</b>	<p><b>12. The only correct answer is B</b></p> <p><b>A</b> is not correct because incorrect observation</p> <p><b>C</b> is not correct because incorrect observation</p> <p><b>D</b> is not correct because incorrect observation</p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>13</b>	<p><b>13. The only correct answer is A</b></p> <p><b>B</b> is not correct because should be slower</p> <p><b>C</b> is not correct because should be half the volume</p> <p><b>D</b> is not correct because should be half the volume</p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>14</b>	<p><b>14. The only correct answer is B</b></p> <p><b>A</b> is not correct because unchanged</p> <p><b>C</b> is not correct because unchanged</p> <p><b>D</b> is not correct because unchanged</p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>15</b>	<p><b>15. The only correct answer is C</b></p> <p><b>A</b> is not correct because it should be constant</p> <p><b>B</b> is not correct because it should be constant</p> <p><b>D</b> is not correct because it should be decreased</p>	<b>(1)</b>

Question Number	Correct Answer	Mark
<b>16</b>	<p><b>16. The only correct answer is A</b></p> <p><b>B</b> is not correct because not necessarily true</p> <p><b>C</b> is not correct because untrue</p> <p><b>D</b> is not correct because untrue</p>	<b>(1)</b>
<b>17</b>	<p><b>17. The only correct answer is B</b></p> <p><b>A</b> is not correct because change in number of moles</p> <p><b>C</b> is not correct because change in number of moles</p> <p><b>D</b> is not correct because change in number of moles</p>	<b>(1)</b>
<b>18</b>	<p><b>18. The only correct answer is B</b></p> <p><b>A</b> is not correct because 0.1 is a tenth of 1000</p> <p><b>C</b> is not correct because incorrect formula for sulfate</p> <p><b>D</b> is not correct because ratio wrong way round</p>	<b>(1)</b>
<b>19</b>	<p><b>19. The only correct answer is C</b></p> <p><b>A</b> is not correct because <math>0.65 \times 390</math>; wrong calculation</p> <p><b>B</b> is not correct because <math>0.65 \times 420</math>; wrong calculation</p> <p><b>D</b> is not correct because <math>10 \times 60</math>; wrong calculation</p>	<b>(1)</b>
<b>20</b>	<p><b>20. The only correct answer is C</b></p> <p><b>A</b> is not correct because wrong type of reaction</p> <p><b>B</b> is not correct because wrong type of reaction</p> <p><b>D</b> is not correct because wrong type of reaction</p>	<b>(1)</b>

**(Total for Section A: 20 marks)**

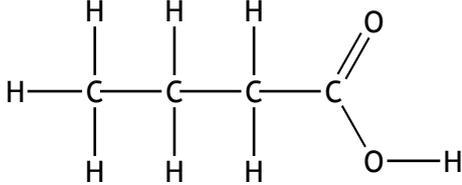
## Section B

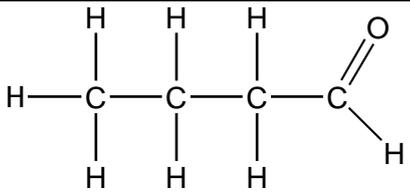
Question Number	Acceptable Answers	Reject	Mark
<b>21(a)(i)</b>	$  \begin{array}{cccc}  \text{H} & \text{H} & \text{H} & \text{H} \\    &   &   &   \\  \text{H}-\text{C} & -\text{C} & -\text{C} & -\text{C}-\text{H} \\    &   &   &   \\  \text{H} & \text{O} & \text{H} & \text{H} \\  &   & & \\  & \text{H} & &   \end{array}  $ <p>ALLOW</p> <p>–OH</p> <p>IGNORE</p> <p>Point of attachment of bond to OH unless horizontal to –HO</p>	Other types of formulae	<b>(1)</b>
<b>21(a)(ii)</b>	$  \begin{array}{c}  \text{CH}_3 \\    \\  \text{H}_3\text{C}-\text{C}-\text{OH} \\    \\  \text{CH}_3  \end{array}  $ <p>/ (CH<sub>3</sub>)<sub>3</sub>C(OH) / other variations eg (CH<sub>3</sub>)<sub>2</sub>C(OH)CH<sub>3</sub></p> <p>ALLOW</p> <p>Displayed or skeletal</p> <p>IGNORE</p> <p>Point of attachment of bond to OH unless horizontal to –HO</p>	Any incorrect structure in a list.	<b>(1)</b>
<b>21(a)(iii)</b>	<p>2-methylpropan-1-ol</p> <p>ALLOW</p> <p>Methylpropan(e)-1-ol / 2-methylpropane-1-ol</p> <p>IGNORE</p> <p>Formulae</p>	2-methylpropanol	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>21(b)(i)</b>	Circle drawn around the peak furthest to the left on the infrared spectrum  OR  Appropriate indication such as a circle around the gap at the top of the peak	Any other additional circles or circles including other additional peaks	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>21(b)(ii)</b>	Find the spectrum that matches / is the same as the spectrum shown / the spectrum in a database  ALLOW  (Compare) fingerprint region		<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>21(c)(i)</b>	Primary / 1° (alcohol)		<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>21(c)(ii)</b>	 <p>ALLOW -OH not displayed</p> <p>IGNORE Name</p>	Other types of formulae	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>21(c)(iii)</b>	 <p>ALLOW</p> <p>Correct formula of butanoic acid if butanal is the answer to (ii)</p> <p>IGNORE</p> <p>Name</p>	<p>Only penalise incorrect side chain once in cii and ciii</p> <p>Only penalise structural or skeletal formulae once in cii and ciii.</p>	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>21(c)(iv)</b>	<p>Type of reaction) Oxidation</p> <p>ALLOW</p> <p>Oxidisation</p> <p>IGNORE</p> <p>'redox'</p>		<b>(1)</b>

**(Total for Question 21 = 9 marks)**

Question Number	Acceptable Answers	Reject	Mark
<b>22(a)(i)</b>	<p>As a (co-) solvent for both (aqueous) silver nitrate and the halogenoalkane</p> <p>OR</p> <p>As a (co-) solvent for polar and non-polar molecules</p> <p>OR</p> <p>To allow the reagents/reactants/halogenoalkane and water to mix/dissolve/become miscible</p> <p>ALLOW</p> <p>Ethanol has both polar and non-polar parts</p> <p>OR</p> <p><b>Just</b> As a co-solvent</p>	<p>Just 'to act as a solvent'</p> <p>Just 'to dissolve the silver nitrate'</p> <p>Just 'to dissolve the halogenoalkane'</p>	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>22 (a)(ii)</b>	<p><math>(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{I} + \text{H}_2\text{O} \rightarrow)</math>  <math>\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} + \text{HI} / \text{H}^+ + \text{I}^-</math></p> <p>IGNORE</p> <p>State symbols, even if incorrect</p>		<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>22(a)(iii)</b>	<p>Butan-1-ol</p> <p>ALLOW</p> <p>1-butanol</p> <p>Butane-1-ol</p>		<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>22(a)(iv)</b>	Nucleophilic <b>(1)</b>		<b>(2)</b>
	Substitution <b>(1)</b>		
	ALLOW		
	1 mark for just S <sub>N</sub> 1 and/or S <sub>N</sub> 2		

Question Number	Acceptable Answers	Reject	Mark
<b>22 (a)(v)</b>	<b>1st mark:</b> Rates of hydrolysis increases from 1-chlorobutane to 1-iodobutane / down the group <b>(1)</b>	Reference to only time taken for hydrolysis	<b>(3)</b>
	<b>2nd mark:</b> C—X bond (energies) decrease in strength / get weaker from C—Cl to C—I <b>(1)</b>	Just 'from chlorine to iodine'	
	<b>3rd mark:</b> So bonds break more easily / quickly / with less energy from C—Cl to C—I <b>(1)</b>		
	IGNORE		
	Bond length arguments / shielding arguments / size of atoms / electronegativity		

Question Number	Acceptable Answers	Reject	Mark
<b>22 (b)(i)</b>	<b>First mark:</b> C—F bond is stronger than the C—Cl bond <b>(1)</b>		<b>(2)</b>
	<b>Second mark:</b> Either C—Cl bond breaks (in stratosphere) forming free radicals (which reacts with ozone) OR Chlorine radicals / Cl• form (which reacts with ozone) <b>(1)</b>		
	<b>IGNORE</b>		
	There is no chlorine in HFCs	HFCs are broken down before they reach the ozone layer	
	Mark each scoring point independently		

Question Number	Acceptable Answers	Reject	Mark
<b>22 (b)(ii)</b>	Some CFCs still being used / CFCs take a (very) long time to reach ozone layer / other chlorine containing compounds / oxides of nitrogen (deplete the ozone layer) / some CFCs remain / some chlorine radicals remain  Allow other explanations that are in line with those above.	CO <sub>2</sub> depletes the ozone layer  Just 'free radicals are present'	<b>(1)</b>

**(Total for Question 22 = 11 marks)**

Question Number	Acceptable Answers	Reject	Mark
<b>23(a)</b>	<p>Final volume would not be (exactly) 250 cm<sup>3</sup> of solution</p> <p>ALLOW</p> <p>Weighing bottle would not have been washed</p> <p>IGNORE</p> <p>Problems due to reactivity of metal hydroxide and water</p>	Not all of the hydroxide will dissolve	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>23 (b)</b>	<p>Pipette</p> <p>ALLOW</p> <p>Recognisable spellings e.g. Pippete</p>	<p>Burette</p> <p>'burette or pipette'</p>	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>23 (c)</b>	<p><b>EITHER</b> (Indicator) Methyl orange <b>(1)</b></p> <p>From yellow <b>(1)</b></p> <p>To orange/ pink / 'peach' (colour)</p> <p>ALLOW red <b>(1)</b></p> <p><b>OR</b> (Indicator) Phenolphthalein <b>(1)</b></p> <p>From (pale) pink <b>(1)</b></p> <p>To colourless <b>(1)</b></p> <p>ALLOW Other indicators</p> <p>IGNORE "Clear"</p> <p>ALLOW 1 out of 2 for the correct colours of either indicator in the reverse order</p>	<p>Phenylphthalein</p> <p>purple / red</p> <p>Litmus / Universal Indicators</p>	<b>(3)</b>

**APPLY T.E. THROUGHOUT PART (d). IGNORE SF EXCEPT 1SF in (ii)-(v) / incorrect units (eg mol/g not g/mol). IGNORE rounding errors.**

Question Number	Acceptable Answers	Reject	Mark
<b>23 (d)(i)</b>	Either Moles HCl ( $= \frac{0.730}{36.5}$ ) = 0.02(00) (mol) <b>(1)</b>  Conc ( $= \frac{0.02(00)}{0.1(00)}$ ) = 0.2(00) (mol dm <sup>-3</sup> ) <b>(1)</b>  OR  Mass HCl in 1 dm <sup>3</sup> = 0.730 x 10 = 7.30 (g dm <sup>-3</sup> ) <b>(1)</b>  Conc = $\frac{7.30}{36.5}$ = 0.2(00) (mol dm <sup>-3</sup> ) <b>(1)</b>		<b>(2)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>23(d)(ii)</b>	(Moles HCl = $\frac{0.2(00) \times 23.80}{1000}$ ) = 0.00476 / 4.76 x 10 <sup>-3</sup> (mol)		<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>23(d)(iii)</b>	(Moles NaOH) = 0.00476 / 4.76 x 10 <sup>-3</sup> (mol)		<b>(1)</b>

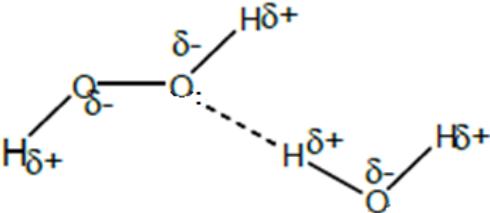
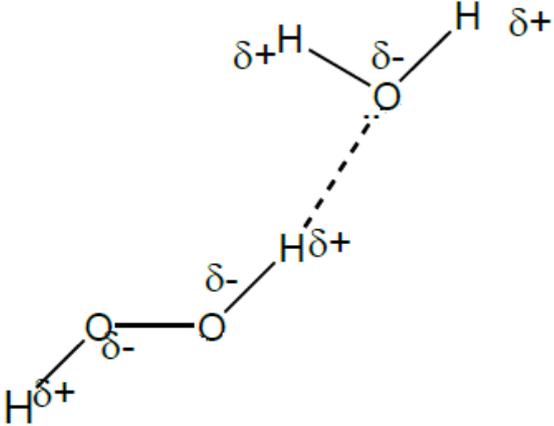
Question Number	Acceptable Answers	Reject	Mark
<b>23(d)(iv)</b>	10 x 0.00476 = 0.0476 / 4.76 x 10 <sup>-2</sup> (mol)		<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>23(d)(v)</b>	(Molar mass = $\frac{1.14}{0.0476}$ ) = 23.9496 (g mol <sup>-1</sup> )		<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>23(d)(vi)</b>	(A <sub>r</sub> = 23.9496 – 17.0 = 6.9496) (so) Li / lithium ALLOW Lithium hydroxide  Allow TE on other group 1 metals providing a calculation of –17 is shown and allow metal hydroxide in this case		<b>(1)</b>

**(Total for Question 23 = 12 marks)**

Question Number	Acceptable Answers	Reject	Mark
<b>24(a)</b>	104 – 105°  ALLOW  94 – 95°		<b>1</b>
Question Number	Acceptable Answers	Reject	Mark
<b>24(b)(i)</b>	(Intermolecular) Hydrogen bond(ing) / H bonding / H bond(s)	Additional types of interaction e.g dipole-dipole attractions, London forces	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
24 (b)(ii)	<p><b>1st mark:</b> At least one lone pair of electrons shown on an O atom even if not the one involved in the hydrogen bond in EITHER H<sub>2</sub>O OR in H<sub>2</sub>O<sub>2</sub> <b>(1)</b></p> <p><b>2nd mark:</b> Hydrogen bond shown between an H atom on one molecule AND an O atom of the other molecule AND O-H-O angle at (about) 180° 180° must be drawn at about 180° not just labelled</p> <p>IGNORE Labelled bond angles even if incorrect. <b>(1)</b></p> <p><b>3rd mark:</b> At least one <math>\delta^+</math> shown on any H atom AND at least one <math>\delta^-</math> shown on any O atom <b>(1)</b></p> <p>EITHER</p>  <p>OR</p> 	<p>Any bond angles labelled as 180° must be between the correct bonds</p> <p>Any full charges Any incorrect partial charges</p>	<b>(3)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>24 (c)</b>	<p><b>First mark:</b> Electronegativity of S lower than that of O OR Electronegativity difference between H and S is less (than that between H and O)</p> <p><b>ALLOW</b> Reverse argument <b>(1)</b></p> <p><b>Second mark:</b> No hydrogen bonding / (only) London forces etc (and dipole-dipole forces) between H<sub>2</sub>S<sub>2</sub> molecules</p> <p><b>OR</b> Hydrogen bonding between H<sub>2</sub>O<sub>2</sub> molecules <b>(1)</b></p>	Award <b>(0) overall</b> if any clear reference to breaking covalent bonds	<b>(2)</b>

**(Total for Question 24 = 7 marks)**

Question Number	Acceptable Answers	Reject	Mark
<b>25 (a)</b>	Outermost / valence <b>electron</b> in a p-orbital / in a p-subshell  OR  (During the build-up of its atoms) last added <b>electron</b> is in a p sub-shell / in a p-orbital  ALLOW  They have a partially filled p-orbital / p sub-shell  The last <b>occupied</b> shell / valence shell ends with p-orbital / p sub-shell	'p shell'	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25 (b)</b>	(Bromine) liquid / (l) <b>(1)</b>  (Iodine) solid / (s) <b>(1)</b>  IGNORE  description, e.g. colour.		<b>(2)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25 (c)(i)</b>	$\text{Cl}_2(\text{g}) / (\text{aq}) + 2\text{Br}^-(\text{aq}) \rightarrow 2\text{Cl}^-(\text{aq}) + \text{Br}_2(\text{aq})$  Species <b>(1)</b>  Balanced and all state symbols correct <b>(1)</b>		<b>(2)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25 (c)(ii)</b>	(Colourless solution turns) brown / orange / red-brown ALLOW Yellow Liquid  IGNORE  pale		<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25(c)(iii)</b>	<p>(Chlorine acts as an) oxidising agent / is an oxidant <b>(1)</b></p> <p>(Chlorine) gains electrons / accepts electrons (from the bromide ions) / causes bromide ions to lose electrons <b>(1)</b></p> <p>IGNORE</p> <p>Oxidation numbers throughout</p>		<b>(2)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25(d)</b>	<p>(At high acidity) an increase in the concentration / high concentration of hydrogen ions / H<sup>+</sup> (ions)</p> <p>ALLOW Increase in (amount of) H<sup>+</sup> (ions) <b>(1)</b></p> <p>Shifts the position of equilibrium to the <b>left</b> (by application of Le Chatelier's principle) / favours the backward reaction <b>(1)</b></p>		<b>(2)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25(e)(i)</b>	<p><math>\text{Br}_2 + 2\text{e}^{(-)} \rightarrow 2\text{Br}^{-}</math></p> <p>ALLOW Multiples No charge on electrons</p> <p>IGNORE state symbols even if incorrect</p>	$\text{Br}_2 \rightarrow 2\text{Br}^{-} - 2\text{e}^{(-)}$	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25(e)(ii)</b>	<p><math>\text{SO}_2 + 2\text{H}_2\text{O} \rightarrow \text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^{(-)}</math></p> <p>ALLOW <math>\text{SO}_2 + 2\text{H}_2\text{O} - 2\text{e}^{(-)} \rightarrow \text{SO}_4^{2-} + 4\text{H}^+</math> Multiples</p> <p>IGNORE state symbols even if incorrect</p>		<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25 e)(iii)</b>	$\text{SO}_2 + 2\text{H}_2\text{O} + \text{Br}_2 \rightarrow \text{SO}_4^{2-} + 4\text{H}^+ + 2\text{Br}^-$ <p>Species <b>(1)</b></p> <p>Balancing (dependent on M1) <b>(1)</b></p> <p>IGNORE</p> <p>state symbols even if incorrect</p> <p>No TE on incorrect half equations in (i) and (ii) except for formation of sulfate(IV)</p> $\text{SO}_2 + \text{H}_2\text{O} + \text{Br}_2 \rightarrow \text{SO}_3^{2-} + 2\text{H}^+ + 2\text{Br}^-$	e <sup>-</sup> left in equation (no M1)	<b>(2)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25 (f)(i)</b>	<p>(acidified) silver nitrate / AgNO<sub>3</sub> (and nitric acid)</p> <p>If name and formula given they must both be correct</p> <p>Note this mark can only be scored if the answer is in this part of (f)</p>	<p>Silver nitrate and sulfuric acid</p> <p>Use of chlorine</p> <p>Use of concentrated sulfuric acid</p>	<b>(1)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25 (f)(ii)</b>	<p>These marks may be scored here from (f)(iv) providing silver nitrate is given in (f)(iii)</p> <p>(With KBr) cream precipitate / off-white precipitate / <b>pale yellow</b> precipitate <b>(1)</b></p> <p>(With KI) yellow precipitate <b>(1)</b></p> <p>ALLOW 'solid' for precipitate in each case</p>	<p><b>Just</b> 'yellow precipitate'</p> <p>Pale yellow precipitate</p>	<b>(2)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25(f)(iii)</b>	<p><b>Concentrated</b> (This can be scored if clear in f(iv)) <b>(1)</b></p> <p>Ammonia (solution) / NH<sub>3</sub>((aq)) <b>(1)</b></p> <p>These 2 marks can be scored with concentrated ammonia given in (f)(i)</p> <p>1 mark can be scored here if ammonia is given in (f)(i)</p>	If given with a substance other than ammonia	<b>(2)</b>

Question Number	Acceptable Answers	Reject	Mark
<b>25(f)(iv)</b>	<p>(With AgBr) precipitate dissolves / precipitate disappears <b>(1)</b></p> <p>(With AgI) precipitate remains <b>(1)</b></p> <p><b>ALLOW</b> Bromide/iodide ions and potassium bromide/iodide as indication of which precipitate is being considered</p> <p><b>IGNORE</b> Colours of any precipitate, even if incorrect, although the colour may be used to identify which precipitate is dissolving if they match the answers in (ii)</p> <p>Note these 2 marks can be scored here if written in (f)(ii) provided in (f)(i) ammonia is mentioned</p>		<b>(2)</b>

**(Total for Question 25 = 21 marks)**

**TOTAL FOR PAPER: 80 MARKS**