

M1.

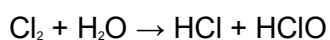
Mark Range	<p>The marking scheme for this part of the question includes an overall assessment for the Quality of Written Communication (QWC). There are no discrete marks for the assessment of QWC but the candidates' QWC in this answer will be one of the criteria used to assign a level and award the marks for this part of the question</p> <p style="text-align: center;">Descriptor</p> <p style="text-align: center;">an answer will be expected to meet most of the criteria in the level descriptor</p>
4-5	<ul style="list-style-type: none"> - claims supported by an appropriate range of evidence - good use of information or ideas about chemistry, going beyond those given in the question - argument well structured with minimal repetition or irrelevant points - accurate and clear expression of ideas with only minor errors of grammar, punctuation and spelling
2-3	<ul style="list-style-type: none"> - claims partially supported by evidence - good use of information or ideas about chemistry given in the question but limited beyond this - the argument shows some attempt at structure - the ideas are expressed with reasonable clarity but with a few errors of grammar, punctuation and spelling
0-1	<ul style="list-style-type: none"> - valid points but not clearly linked to an argument structure - limited use of information or ideas about chemistry - unstructured - errors in spelling, punctuation and grammar or lack of fluency

(a) Kills bacteria / prevents bacterial diseases QWC

1

Chlorine is a toxic substance

1



1

(b)	Cl ₂ (aq) to Br ⁻ (aq);	yellow-orange or yellow-red or QWC yellow-brown solution	1
		2Br ⁻ + Cl ₂ → 2Cl ⁻ + Br ₂ or molecular equation	1
	Cl ₂ (aq) to I ⁻ (aq);	brown/black solution formed or QWC black/brown/grey ppt/solid	1
		2I ⁻ + Cl ₂ → 2Cl ⁻ + I ₂ or molecular equation	1
(c)	Bromide:	Brown/orange fumes	1
		Bromine produced	1
		Sulphur dioxide produced	1
	Iodide:	Purple fumes or black/brown/grey solid QWC or smell of bad eggs	1
		Iodine produced	1
		SO ₂ , S, H ₂ S produced (one mark each)	3
	Half-equations	2Br ⁻ → Br ₂ + 2e ⁻ OR 2I ⁻ → I ₂ + 2e ⁻	1
		H ₂ SO ₄ + 2e ⁻ + 2H ⁺ → SO ₂ + 4H ₂ O OR H ₂ SO ₄ + 6e ⁻ + 6H ⁺ → S + 4H ₂ O OR H ₂ SO ₄ + 8e ⁻ + 8H ⁺ → H ₂ S + 4H ₂ O	1
	Overall equation	Any correct equation based on half-equations QWC	1

[18]

M2.	(a)	decreases;	1
		increase in shielding ;	1
		(or atomic radius)	
		less attraction for bonding (or shared) electrons;	1
	(b)	brown solution;	1
		(or black solid)	
		$\text{Cl}_2 + 2\text{KI} \rightarrow 2\text{KCl} + \text{I}_2$;	
		(or ionic equation)	1
	(c)	SO_2 ;	1
		$\text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^- \rightarrow \text{SO}_2 + 2\text{H}_2\text{O}$;	1
		S (also H_2S);	1
		$\text{SO}_4^{2-} + 8\text{H}^+ + 6\text{e}^- \rightarrow \text{S} + 4\text{H}_2\text{O}$ (or $\text{SO}_4^{2-} + 10\text{H}^+ + 6\text{e}^- \rightarrow \text{H}_2\text{S} + 4\text{H}_2\text{O}$)	1
	(d)	$\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$;	1
		sodium chloride;	1
		-1;	1
		sodium chlorate(I) (or bleach etc);	1
		+1;	1

[14]

M3.	(a)	decreases	1
		number of shells increases/ shielding increases /atomic size increases	
		weaker attraction (by nucleus) on bonding electrons / weaker attraction (by nucleus)	1
		on electron pair in a covalent bond	1
	(b)	(i) increases	1
		(ii) concentrated sulphuric acid	1
	(c)	white ppt	1
		soluble in ammonia	1
		cream ppt	1
		partially soluble /insoluble in ammonia	1
	(d)	$\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$	1
		bleach	1
		disinfectant /steriliser/kills bacteria	1

[12]

- M4.** (a) Reduction involves gain of electrons (1)
A reducing agent loses (donates) electrons (1)

2

- (b) (i) Sulphur dioxide (1)
oxidation state +4 (1)
Sulphur (1)
oxidation state 0 (1)
Hydrogen sulphide (1)
oxidation state – 2 (1)

6

- (ii) Sulphur dioxide is a choking gas or has a pungent odour (1)
Sulphur is a yellow solid (1)
Hydrogen sulphide has a smell of bad eggs (1)
Any 2 marks

2

- (iii) $\text{SO}_4^{2-} + 4\text{H}^+ + 2\text{e}^- \rightarrow \text{SO}_2 + 2\text{H}_2\text{O}$ (1)
 $\text{SO}_4^{2-} + 8\text{H}^+ + 6\text{e}^- \rightarrow \text{S} + 4\text{H}_2\text{O}$ (1)
 $\text{SO}_4^{2-} + 10\text{H}^+ + 8\text{e}^- \rightarrow \text{H}_2\text{S} + 4\text{H}_2\text{O}$ (1)
Any 2 marks
(Allow equations with H_2SO_4)

2

- (c) $\text{Cl}_2 + \text{H}_2\text{O} \rightarrow \text{H}^+ + \text{Cl}^- + \text{HOCl}$
or $\text{Cl}_2 + \text{H}_2\text{O} \rightarrow 2\text{H}^+ + \text{Cl}^- + \text{OCl}^-$
or $\text{Cl}_2 + \text{H}_2\text{O} \rightarrow \text{HCl} + \text{HOCl}$ (1)

Water is not oxidised (1)

The oxidation states of O (-2) and H (+1) remain unchanged (1)

3

[15]