10 Group 7(17), the halogens
Answers to practice questions

Question number	Answer	Marks	Guidance
1 (a)	Decreases number of levels increases *or* the shielding increases *or* the atomic size increases therefore there is weaker attraction by nucleus on bonding pair of electrons in the covalent bond	1 1 1	Learn the trend since you will lose the next marks if the trend is wrong.
1 (b) (i)	increases	1	Think of this as the halide ion that can be oxidised itself the most easily. This may help.
1 (b) (ii)	concentrated sulfuric acid	1	
1 (c)	white precipitate soluble in ammonia cream precipitate partially soluble / insoluble in ammonia	1 1 1 1	You really need to learn the colours of the precipitates. Silver chloride is a white solid and silver bromide is cream. The question only asks about the effect of dilute ammonia so don't say that 'the cream precipitate dissolves in conc. ammonia'. Just answer the question.
1 (d)	$Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$ bleach disinfectant *or* steriliser *or* kills bacteria	1 1 1	
2 (a)	reduction is gain of electrons a reducing agent donates electrons	1 1	*Or* reducing agents give electrons away. Do not say electron pairs!
2 (b) (i)	sulfur dioxide oxidation state +4 sulfur oxidation state 0 hydrogen sulfide oxidation state −2	1 1 1 1 1 1	This is often answered very badly since candidates do not learn the reduction products well. You can always work out the oxidation states if you do not want to learn them.
2 (b) (ii)	*any two from:*	2	

	• sulfur dioxide is a choking gas or has a pungent odour • sulfur is a yellow solid • hydrogen sulfide has a smell of bad eggs		
2 (b) (iii)	any two from: $SO4^{2-} + 4H^+ + 2e^- \rightarrow SO_2 + 2H_2O$ $SO4^{2-} + 8H^+ + 6e^- \rightarrow S + 4H_2O$ $SO4^{2-} + 10H^+ + 8e^- \rightarrow H_2S + 4H_2O$	2	Equations with H2SO4 are allowed. Make sure the equations match up to the products you choose.
2 (c)	$Cl_2 + H_2O \rightarrow H^+ + Cl^- + HOCl$ *or* $Cl_2 + H_2O \rightarrow 2H^+ + Cl^- + OCl^-$ *or* $Cl_2 + H_2O \rightarrow HCl + HOCl$ water is not oxidised the oxidation states of O (−2) and H (+1) remain unchanged	1 1 1	If you say the water is not oxidised – it is reduced – you lose the mark because water is neither oxidised nor reduced.
3 (a)	Increase van der Waals forces between molecules increase with size or M_r or surface area more energy needed to overcome these forces	1 1 1 1	If you do not mention molecules somewhere in the answer you will lose one mark. If the trend is wrong you lose all the marks in (a).
3 (b) (i)	brown / yellow / orange solution $Cl_2 + 2Br- \rightarrow 2Cl- + Br_2$	1 1	You must state the colour and the fact that it is a solution.
3 (b) (ii)	cream precipitate, precipitate dissolves (since the question asks about conc. Ammonia) $Br^- + Ag^+ \rightarrow AgBr$	1 1	
3 (b) (iii)	orange / brown fumes / gas, white / misty fumes, choking gas (any 2 for 1 mark) $2H^+ + H_2SO_4 + 2Br^- \rightarrow SO_2 + Br_2 + 2H_2O$	1 2	If you cannot complete the equation you must always do as much as you can. Just getting the products SO2 and Br2 will get you one of the marks, and balance the equation if you can.
3 (c)	*any two from:* H_2S and $8e^- + 8H^+ + H_2SO_4 \rightarrow H_2S + 4H_2O$ *or* equation with SO_4^{2-} S and $SO_4^{2-} + 8H^+ + 6e^- \rightarrow S + 4H_2O$ *or*	2	

	equation with H_2SO_4 SO_2 and $SO_4^{2-} + 4H^+ + 2e^- \rightarrow SO_2 + 2H_2O$ *or* equation with H_2SO_4		
4 (a)	Decreases increase in shielding / increase in atomic radius less attraction for bonding pair of electrons	1 1 1	
4 (b)	brown solution or black solid $Cl_2 + 2KI \rightarrow 2KCl + I_2$	1 1	Iodine is a black solid but gives a brown solution. You must not refer to iodine as purple since that is iodine gas / vapour. You can write an ionic equation here instead.
4 (c)	SO_2 $SO_4^{2-} + 4H^+ + 2e^- \rightarrow SO_2 + 2H_2O$ S $SO_4^{2-} + 8H^+ + 6e^- \rightarrow S + 4H_2O$	1 1 1 1	You can have H_2S and its equation as an alternative. You need two out of S, SO_2 and H_2S for 2 marks and the correct associated equations for another 2 marks. H_2S $SO_4^{2-} + 10H^+ + 6e^- \rightarrow H_2S + 4H_2O$
4(d)	$Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$ sodium chloride −1 sodium chlorate(I) +1	1 1 1 1 1	 The name shows the +1 oxidation state of the chlorine in NaOCl
5 (a) (i)	**M1** iodine ***OR*** I_2 ***OR*** I^{3-} **M2** $Cl_2 + 2I \rightarrow 2Cl^- + I_2$ ***OR*** $\frac{1}{2}Cl_2 + I \rightarrow Cl^- + \frac{1}{2}I_2$ **M3** redox or reduction-oxidation or displacement	3	Ignore state symbols Credit **M1** for "iodine solution" Penalise multiples in M2 except those shown **M2** accept correct use of **I3–**
5 (a) (ii)	**M1 (**the white precipitate is) <u>silver chloride</u> **M2** $Ag^+ + Cl \rightarrow AgCl$	3	**M1** <u>must be named</u> and for <u>this mark</u> ignore incorrect formula For **M2** ignore state symbols

	M3 (white) precipitate / it <u>dissolves</u> ***OR*** <u>colourless solution</u>		Penalise multiples Ignore references to "clear" alone
5 (b) (i)	**M1** H_2SO_4 + **2**Cl → **2**HCl + SO_4^{2-} ***OR*** H_2SO_4 + Cl → HCl + HSO^{4-} ***OR*** H^+ + Cl → HCl **M2** hydrogen chloride ***OR*** HCl ***OR*** hydrochloric acid	2	For **M1** ignore state symbols Penalise multiples for equations and apply the list principle
5 (b) (ii)	**M1 and M2 in either order** **M1 2**I → I_2 + **2**e^- ***OR*** **8**I → **4**I_2 + **8**e^- **M2** H_2SO_4 + **8**H^+ + **8**e → H_2S + **4**H_2O **OR** SO_4^{2-} + **10**H^+ + **8**e → H_2S + **4**H_2O **M3** <u>oxidising agent / oxidises the iodide (ions)</u> ***OR*** <u>electron acceptor</u> **M4** sulfur ***OR*** S ***OR*** S_2 ***OR*** S_8 ***OR*** sulphur	4	For **M1** and **M2**, ignore state symbols and credit multiples Do not penalise absence of charge on the electron Credit electrons shown correctly on the other side of each equation Additional equations should not contradict
5 (b) (iii)	**M1** <u>The NaOH / OH^- / (sodium) hydroxide reacts with / neutralises the H^+ / acid / HBr</u> (lowering its concentration) ***OR*** a correct neutralisation equation for H^+ or HBr with NaOH or with hydroxide ion **M2 Requires a correct statement for M1** The (position of) <u>equilibrium moves / shifts</u> (from L to R) • <u>to replace the H^+ / acid / HBr that has been removed / lost</u> • ***OR*** to <u>increase the H^+ / acid / HBr concentration</u> • ***OR*** to <u>make more H^+ / acid / HBr / product(s)</u> • ***OR*** to <u>oppose the loss of H^+ / loss of product(s)</u> • ***OR*** to <u>oppose the decrease in concentration</u> of product(s) **M3** The (health) benefit outweighs the risk or wtte ***OR*** a clear statement that once it has done its job, little of it remains	3	Ignore reference to NaOH reacting with bromide ions Ignore reference to NaOH reacting with HBrO alone In **M2**, answers must refer to the (position of) <u>equilibrium shifts / moves</u> and is not enough to state simply that it / the system / the reaction shifts to oppose the change.

	OR used in (very) dilute concentrations / small amounts / low doses		