Answers to examination-style questions

Answers	Marks	Examiner's tips
1 (a) decreases	**1**	Learn the trend since you will lose the next marks if the trend is wrong.
number of levels increases *or* the shielding increases *or* the atomic size increases	**1**	
therefore there is weaker attraction by nucleus on bonding pair of electrons in the covalent bond	**1**	
(b) (i) increases	**1**	Think of this as the halide ion that can be oxidised itself the most easily. This may help.
(ii) concentrated sulfuric acid	**1**	
(c) white precipitate	**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.
soluble in ammonia	**1**	
cream precipitate	**1**	
partially soluble / insoluble in ammonia	**1**	
(d) $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$	**1**	
bleach	**1**	
disinfectant *or* steriliser *or* kills bacteria	**1**	
2 (a) reduction is gain of electrons	**1**	
a reducing agent donates electrons	**1**	*Or* reducing agents give electrons away. Do not say electron pairs!
(b) (i) sulfur dioxide	**1**	
oxidation state +4	**1**	
sulfur	**1**	
oxidation state 0	**1**	
hydrogen sulfide	**1**	
oxidation state −2	**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.
(ii) *any two from:* • 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**	
(iii) *any two from:* $SO_4^{2-} + 4H^+ + 2e^- \rightarrow SO_2 + 2H_2O$ $SO_4^{2-} + 8H^+ + 6e^- \rightarrow S + 4H_2O$ $SO_4^{2-} + 10H^+ + 8e^- \rightarrow H_2S + 4H_2O$	**2**	Equations with H_2SO_4 are allowed. Make sure the equations match up to the products you choose.

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(c) $Cl_2 + H_2O \rightarrow H^+ + Cl^- + HOCl$ *or* $Cl_2 + H_2O \rightarrow 2H^+ + Cl^- + OCl^-$ *or* $Cl_2 + H_2O \rightarrow HCl + HOCl$	**1**	
water is not oxidised	**1**	If you say the water is not oxidised – it is reduced – you lose the mark
the oxidation states of O (−2) and H (+1) remain unchanged	**1**	because water is neither oxidised nor reduced.
3 (a) increase	**1**	
van der Waals forces between molecules	**1**	If you do not mention molecules
increase with size or M_r or surface area	**1**	somewhere in the answer you will
more energy needed to overcome these forces	**1**	lose one mark. If the trend is wrong you lose all the marks in (a).
(b) (i) brown / yellow / orange solution	**1**	You must state the colour and the fact that it is a solution.
$Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$	**1**	
(ii) cream precipitate, precipitate dissolves (since the question asks about conc. ammonia)	**1**	
$Br^- + Ag^+ \rightarrow AgBr$	**1**	
(iii) orange / brown fumes / gas, white / misty fumes, choking gas (*any 2 for 1 mark*)	**1**	
$2H^+ + H_2SO_4 + 2Br^- \rightarrow SO_2 + Br_2 + 2H_2O$	**2**	If you cannot complete the equation you must always do as much as you can. Just getting the products SO_2 and Br_2 will get you one of the marks, and balance the equation if you can.
(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* equation with H_2SO_4	**2**	
SO_2 and $SO_4^{2-} + 4H^+ + 2e^- \rightarrow SO_2 + 2H_2O$ *or* equation with H_2SO_4		
4 (a) decreases	**1**	
increase in shielding / increase in atomic radius	**1**	
less attraction for bonding pair of electrons	**1**	
(b) brown solution or black solid	**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.
$Cl_2 + 2KI \rightarrow 2KCl + I_2$	**1**	You can write an ionic equation here instead.

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(c) SO_2	**1**	
$SO_4^{2-} + 4H^+ + 2e^- \rightarrow SO_2 + 2H_2O$	**1**	
S	**1**	
$SO_4^{2-} + 8H^+ + 6e^- \rightarrow S + 4H_2O$	**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
		$SO_4^{2-} + 10H^+ + 6e^- \rightarrow H_2S + 4H_2O$
(d) $Cl_2 + 2NaOH \rightarrow NaCl + NaOCl + H_2O$	**1**	
sodium chloride	**1**	
−1	**1**	
sodium chlorate(I)	**1**	
+1	**1**	The name shows the +1 oxidation state of the chlorine in NaOCl
5 (a) fluorine *or* F_2 *or* F	**1**	Do not use the symbol Fl – it is wrong.
(b) I^-	**1**	
(c) *observation with NaF(aq):* no change or colourless solution	**1**	
observation with NaI(aq): yellow solid / precipitate	**1**	
equation: $I^-(aq) + Ag^+(aq) \rightarrow AgI(s)$ *or* $NaI(aq) + AgNO_3(aq) \rightarrow NaNO_3(aq) + AgI(s)$	**1**	Since the question asks for state symbols, if you miss them out you do not get the equation mark.
(d) *observation*: steamy / white / misty fumes	**1**	Do not say smoke.
Equation: $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$	**1**	
(e) *any two from:* black solid or purple gas / choking fumes / yellow solid / smell bad eggs	**2**	The smell must be of bad eggs not just an eggy smell.
the equation can be one of a choice of three. one example is $2NaI + 2H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O + I_2 + SO_2$	**2**	There should be two reduction products from Na_2SO_4, e.g. H_2S and $I_2(s)$ or SO_2 and I_2 or S and I_2, for the first mark. The second mark is for completing and balancing the equation.

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6 (a) increases from fluorine to iodine	**1**	
sizes of molecules increase	**1**	
magnitude of intermolecular forces increases *or* more van der Waals forces	**1**	
more energy required to separate molecules *or* more energy to break intermolecular forces	**1**	This is the energy needed to overcome the forces between the molecules not the bonds in the molecules.
(b) *with NaCl:* when aqueous silver nitrate added white precipitate formed	**1**	You must state the colour and that there is a precipitate or solid.
soluble in **dilute aqueous** ammonia	**1**	If precipitate clearly refers to wrong substance, e.g. NaCl dissolving, then this will not get the mark.
with NaBr: when aqueous silver nitrate added cream or off-white precipitate formed	**1**	
partially soluble (or insoluble) in **dilute aqueous** ammonia	**1**	The question refers to **dilute aqueous** ammonia only.
(c) oxidising ability decreases from chlorine to iodine	**1**	
$Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$	**1**	
Br_2 brown / yellow/ orange liquid or solution	**1**	State liquid or solution. Bromine cannot be solid so don't say brown solid because you will lose the mark.
$Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$	**1**	
I_2 brown solution / black solid	**1**	No reference to purple at all. That would be iodine vapour and this is in solution.
$Br_2 + 2I^- \rightarrow 2Br^- + I_2$	**1**	
yellow / orange / brown solution goes brown / darker brown solution / black solid	**1**	
7 (a) to kill bacteria or sterilise water	**1**	This is not to purify water.
(b) *equation:* $Cl_2 + H_2O \rightleftharpoons HClO + HCl$	**1**	
identity of substance: chlorine *or* Cl_2	**1**	
8 (a) decrease	**1**	
number of shells increases *or* atomic radius increases	**1**	
increased nuclear shielding *or* less attraction for bond pair of electrons	**1**	If the trend is wrong then this is a chemical error and you will lose all three marks.

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(b) (i) *observation:* brown solution or black solid	**1**	Do not make reference to purple. This would be iodine vapour and this is wrong.
equation: $Br_2 + 2I^- \rightarrow I_2 + 2Br^-$	**1**	If you do not like ionic equations then you could use NaI or KI instead of just I^- here.
(ii) Br_2 is a weaker oxidising agent than Cl_2	**1**	You could say Br_2 is less reactive than Cl_2
(c) *observation with KF(aq):* no change	**1**	
observation with KBr(aq): cream / off-white ppt / solid	**1**	
(d) $KF + H_2SO_4 \rightarrow KHSO_4 + HF$ *or* $2KF + H_2SO_4 \rightarrow K_2SO_4 + 2HF$	**1**	
(e) $2H_2SO_4 + 2Br^- \rightarrow SO_2 + Br_2 + 2H_2O + SO_4^{2-}$	**2**	One mark is for the products $SO_2 + Br_2$ and the second mark for completing and balancing the equation. $2H_2SO_4 + 2NaBr \rightarrow SO_2 + Br_2 + 2H_2O + Na_2SO_4$ is allowed.
9 (a) (i) −2	**1**	
(ii) NaI *or* NaAt *or* I^- *or* iodide or At^- *or* astatide	**1**	Do not refer to molecules, e.g. I_2
(iii) smell of bad eggs	**1**	
(iv) $8e^- + 8H^+ + H_2SO_4 \rightarrow H_2S + 4H_2O$ *or* $8e^- + 10H^+ + SO_4^{2-} \rightarrow H_2S + 4H_2O$	**1**	
(b) (i) HF *or* HCl	**1**	
(ii) NaF *or* NaCl *or* F^- *or* Cl^-	**1**	
(iii) a proton donor	**1**	You could say it behaves as an acid.
(iv) $H^+ + F^- \rightarrow HF$ *or* $H_2SO_4 + NaF \rightarrow NaHSO_4 + HF$ *or* $H_2SO_4 + 2NaF \rightarrow Na_2SO_4 + 2HF$ *or* similar equations for chloride	**1**	