

# 11. Group 17

## 11.3 Some reactions of the halide ions

### Paper 2

#### Marking Scheme

## Q1.

(d)(i)	$\text{NaBr} + \text{H}_2\text{SO}_4 \rightarrow \text{HBr} + \text{NaHSO}_4$ <b>OR</b> $2\text{NaBr} + \text{H}_2\text{SO}_4 \rightarrow 2\text{HBr} + \text{Na}_2\text{SO}_4$	<b>1</b>
(d)(ii)	<b>M1</b> sodium chloride <b>M2</b> $\text{Cl}^-$ is not a strong enough reducing agent to reduce $\text{H}_2\text{SO}_4$ <b>M3</b> $\text{Br}^-$ & $\text{I}^-$ are strong enough reducing agents to react (further) with (the S in) $\text{H}_2\text{SO}_4$  <i>Alternative M2 and M3</i> <b>M2</b> ability to behave as reducing agents increases down the group <b>M3 EITHER</b> $\text{Cl}^-$ is not strong enough to reduce $\text{H}_2\text{SO}_4$ <b>OR</b> $\text{Br}^-$ and $\text{I}^-$ react (further) with (the S in) $\text{H}_2\text{SO}_4$	<b>3</b>

## Q2.

(c)	$(\text{Br}_2)$ no visible reaction <b>OR</b> colourless to orange / brown / yellow solution	<b>1</b>
	(conc. $\text{H}_2\text{SO}_4$ ) no visible reaction <b>OR</b> Solution remains colourless	<b>1</b>
	(dil. $\text{AgNO}_3$ ) white precipitate forms	<b>1</b>

## Q3.

(d)	step	method	observation with $\text{CaCl}_2$	observation with $\text{CaBr}_2$	observation with $\text{CaI}_2$	<b>3</b>
	step 1	$\text{AgNO}_3(\text{aq})$ (+ $\text{HNO}_3(\text{aq})$ )	white ppt	cream <b>OR</b> off-white ppt	(pale) yellow ppt	
	step 2	$\text{NH}_3(\text{aq})$	(ppt) dissolves / (completely) soluble (in dilute or conc) <b>OR</b> (forms) colourless solution	(ppt) partly soluble / slightly soluble (in dilute or conc) <b>ALLOW</b> (ppt) dissolves in excess (in dilute or conc) <b>ALLOW</b> (ppt) soluble in <b>conc.</b> $\text{NH}_3$	(ppt) insoluble / solid remains (in dilute or concentrated)	
<b>M1</b> step 1 $\text{AgNO}_3(\text{aq})$ / silver nitrate solution <b>AND</b> step 2 $\text{NH}_3(\text{aq})$ / ammonia solution / dilute $\text{NH}_3$ / concentrated $\text{NH}_3$ <b>M2</b> ALL solid / precipitate <b>AND</b> correct colours described in row 1 <b>M3</b> correct observations on addition of ammonia						

## Q4.

(d)(i)	acid-base	1
(d)(ii)	$8\text{HI} + \text{H}_2\text{SO}_4 \rightarrow 4\text{I}_2 + \text{H}_2\text{S} + 4\text{H}_2\text{O}$ <b>OR</b> $8\text{H}^+ + 8\text{I}^- + \text{H}_2\text{SO}_4 \rightarrow 4\text{I}_2 + \text{H}_2\text{S} + 4\text{H}_2\text{O}$	1
(d)(iii)	<i>explanation in terms of comparison of reducing nature of HI to HCl</i> i.e. HI / I <sup>-</sup> is stronger reducing agent compared to Cl <sup>-</sup> / HCl <b>OR</b> <i>explanation in terms of additional behaviour of HI (compared to HCl)</i> i.e. HI / I <sup>-</sup> reduces S (in sulfuric acid) / (concentrated) sulfuric acid	1

## Q5.

(c)	white ppt / solid /	1
	solid (re)dissolves (on addition of NH <sub>3</sub> )	1

## Q6.

(a)(i)	$\text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{NaHSO}_4 + \text{HCl}$ <b>OR</b> $2\text{NaCl} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{HCl}$	1
(a)(ii)	displacement / acid-base (reaction)	1
(b)(i)	hydrogen iodide / HI	1
(b)(ii)	dark grey solid I <sub>2</sub> / iodine	1
	other product S / sulfur OR H <sub>2</sub> S / hydrogen sulfide OR H <sub>2</sub> O / water / steam	1
(c)	<b>M1</b> iodide ions are strong(er) reducing agents (than chloride ions) ORA	1
	<b>M2</b> HI / iodide is oxidised OR HCl / chloride is not oxidised	1
(d)	$2\text{Br}^- + 2\text{H}^+ + \text{H}_2\text{SO}_4 \rightarrow \text{Br}_2 + 2\text{H}_2\text{O} + \text{SO}_2$	1

## Q7.

(a)	<b>M1</b> cream	1
	<b>M2</b> AgBr	1
(e)	<b>M1 reagent:</b> concentrated sulfuric acid	1
	<b>M2 observation:</b> brown vapour / gas (forms)	1

**Q8.**

(a)(i)	Bromine / Br	<b>1</b>
(a)(ii)	$\text{Ag}^+(\text{aq}) + \text{X}^-(\text{aq}) \rightarrow \text{AgX}(\text{s})$ OR $\text{Ag}^+(\text{aq}) + \text{Br}^-(\text{aq}) \rightarrow \text{AgBr}(\text{s})$	<b>1</b>
(a)(iii)	<b>M1 reagent</b> Add (aqueous) ammonia <b>M2 expected result</b> <b>EITHER</b> (Dilute ammonia) – partial amount precipitate dissolves OR not much precipitate dissolves <b>OR</b> add concentrated ammonia – precipitate dissolves	<b>2</b>