Solutions

Each answer shows the steps, then the **result**.

2.1

(a)

- white

(b)

- yellow

2.2

- reducing power increases down the group

3.1 B

- A cream precipitate dissolving only in concentrated ammonia is bromide

3.2 C

- Iodide is the strongest reducing agent, reducing the acid to H_2S

3.3

(a)

- add silver nitrate to each — both give a precipitate; chloride gives white, iodide gives yellow; add ammonia — the chloride (white) dissolves in dilute ammonia, the iodide (yellow) is insoluble

(b)

- iodide ions are stronger reducing agents (lose their electron more easily), so they reduce the sulfuric acid; chloride ions are too weak a reducing agent

3.4

- $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

3.5

(a)

- NaCl: steamy white fumes of HCl only — no redox occurs. NaBr: steamy fumes of HBr, plus orange-brown bromine vapour and a colourless choking gas, **sulfur dioxide**. NaI: purple-black iodine, a yellow solid (sulfur) and the smell of bad eggs — **hydrogen sulfide**

(b)

- Reducing power increases down the group; the ion gets larger, so its outermost electron is further from the nucleus and better shielded and is lost more easily; iodide can

therefore reduce sulfur from +6 all the way to −2, whereas chloride cannot reduce it at all

(c)

- Acidify with dilute nitric acid, then add aqueous silver nitrate. White precipitate = chloride, cream = bromide, yellow = iodide. The white dissolves in **dilute** ammonia; the cream dissolves only in **concentrated** ammonia, and the yellow dissolves in neither

(d)

- To remove carbonate and other ions that would themselves precipitate with silver nitrate and give a false positive