

Question 22 (Answer: D)

- A halogen displaces only the halide ions *below* it in the group.
- Iodine sits below bromine, so it is the weaker oxidising agent.
- It cannot oxidise bromide ions, so nothing happens.

Question 23 (Answer: B)

- Ammonia is a weak base, so its solution holds both NH_3 and the NH_4^+ formed from it.
- NH_4^+ can donate a proton, which is the Brønsted–Lowry definition of an acid.
- Nitrogen is unreactive because of a strong *triple* bond, and it does have a lone pair – so A and C fail.

1(a)(i)	(halogens can) remove electron(s) (from a reactant)																
1(a)(ii)	$2\text{Al} + 3\text{Cl}_2 \rightarrow 2\text{AlCl}_3$																
1(a)(iii)	purple (gas) disappears																
1(b)(i)	M1 Br—Br is weaker (than Cl—Cl) AND Br atoms are larger M2 less (significant) overlap of orbitals (in Br-Br)																
1(b)(ii)	HCl is more thermally stable																
1(b)(iii)	M1 (enthalpy change / energy change) when one mole of a compound / substance is formed M2 from its (constituent) elements in their standard state(s)																
1(b)(iv)	M1 $(6 \times -92) - (2 \times -46) =$ M2 $-460 \text{ (kJ mol}^{-1}\text{)}$																
1(b)(v)	M1 (trigonal) pyramidal M2 three bonding pairs AND one lone pair (of electrons)																
1(c)(i)	<table><tr><td></td><td>NaCl</td><td>NaBr</td><td>NaI</td></tr><tr><td>with $\text{Ag}^+(\text{aq})$</td><td>white precipitate</td><td>M1 cream / off-white ppt</td><td>M2 yellow ppt</td></tr><tr><td>with conc. H_2SO_4</td><td>acid – base</td><td>acid – base, then redox</td><td>acid – base, then redox</td></tr><tr><td>observations with conc. H_2SO_4</td><td>M3 steamy fumes OR fizzing</td><td>M4 brown liquid OR fizzing</td><td> • black solid • yellow solid • effervescence </td></tr></table>		NaCl	NaBr	NaI	with $\text{Ag}^+(\text{aq})$	white precipitate	M1 cream / off-white ppt	M2 yellow ppt	with conc. H_2SO_4	acid – base	acid – base, then redox	acid – base, then redox	observations with conc. H_2SO_4	M3 steamy fumes OR fizzing	M4 brown liquid OR fizzing	• black solid • yellow solid • effervescence
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1(c)(ii)	M1 black solid = iodine / I_2 AND yellow solid = sulfur / $\text{S}_{(8)}$ M2 effervescence = hydrogen sulfide / $\text{H}_2\text{S(g)}$																
1(d)(i)	M1 MgCl_2 (is ionic and) has mobile ions M2 SiCl_4 is covalent AND no charge carriers OR (no ions and) no delocalised electrons OR no mobile / moving ions																
1(d)(ii)	M1 MgCl_2 pH = 7 M2 SiCl_4 pH 0 – 4																