

Question 21 (Answer: **A**)

- Hot concentrated alkali disproportionates chlorine: $3\text{Cl}_2 + 6\text{NaOH} \rightarrow 5\text{NaCl} + \text{NaClO}_3 + 3\text{H}_2\text{O}$.
- So three moles of chlorine give just one of NaClO_3 : $0.600/3 = 0.200$ mol.
- $M_r = 106.5$, so the mass is $0.200 \times 106.5 = 21.3$ g.

Question 22 (Answer: **B**)

- In *hot* alkali chlorine disproportionates all the way to chloride and chlorate(V).
- $3\text{Cl}_2 + 6\text{OH}^- \rightarrow 5\text{Cl}^- + \text{ClO}_3^- + 3\text{H}_2\text{O}$.
- ClO^- is the *cold*-alkali product, so it is not present here.

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 (kJ mol ⁻¹)																		
1(b)(v)	M1 (trigonal) pyramidal M2 three bonding pairs AND one lone pair (of electrons)																		
1(c)(i)	<table border="1"> <thead> <tr> <th></th><th>NaCl</th><th>NaBr</th><th>NaI</th></tr> </thead> <tbody> <tr> <td>with Ag⁺(aq)</td><td>white precipitate</td><td>M1 cream / off-white ppt</td><td>M2 yellow ppt</td></tr> <tr> <td>with conc. H₂SO₄</td><td>acid – base</td><td>acid – base, then redox</td><td>acid – base, then redox</td></tr> <tr> <td>observations with conc. H₂SO₄</td><td>M3 steamy fumes OR fizzing</td><td>M4 brown liquid OR fizzing</td><td> - black solid - yellow solid - effervescence </td></tr> </tbody> </table>				NaCl	NaBr	NaI	with Ag ⁺ (aq)	white precipitate	M1 cream / off-white ppt	M2 yellow ppt	with conc. H ₂ SO ₄	acid – base	acid – base, then redox	acid – base, then redox	observations with conc. H ₂ SO 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 / S ₈ M2 effervescence = hydrogen sulfide / H ₂ 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																		