

1 The Group 17 elements are oxidising agents.

(a) (i) Explain how the Group 17 elements act as oxidising agents.

.....
 [1]

(ii) Write an equation to show the reaction in which Cl_2 oxidises aluminium metal.

..... [1]

(iii) A student heats equal amounts of $I_2(g)$ and $H_2(g)$ in a sealed flask. The student leaves the contents to cool.

State what you would observe during the reaction.

..... [1]

(b) Cl_2 and Br_2 can each react with NH_3 to give N_2 and a hydrogen halide, HX .



The relative bond strengths of $X-X$ and $H-X$ determine the difference in enthalpy change of the two reactions.

(i) Describe and explain the difference in the $X-X$ bond strengths of Cl_2 and Br_2 .

.....

 [2]

(ii) Describe the relative thermal stabilities of HCl and HBr .

..... [1]

(iii) Define enthalpy change of formation, ΔH_f .

.....
 [2]

(iv) Table 1.1 gives data relevant to the reaction of $Cl_2(g)$ with $NH_3(g)$.

Table 1.1

compound	enthalpy change of formation, $\Delta H_f / \text{kJ mol}^{-1}$
$NH_3(g)$	-46
$HCl(g)$	-92

Use the data in Table 1.1 to calculate the enthalpy change of the reaction of $Cl_2(g)$ with $NH_3(g)$.

enthalpy change of reaction = kJ mol^{-1} [2]

(v) I_2 reacts with NH_3 to form NI_3 .

Predict the shape of a molecule of NI_3 . Explain your answer.

shape
 explanation
 [2]

(c) Table 1.2 shows some information about reactions of NaCl, NaBr and NaI.

Table 1.2

	NaCl	NaBr	NaI
observation with Ag ⁺ (aq)	white precipitate		
type of reaction with concentrated H ₂ SO ₄	acid–base	acid–base, then redox	acid–base, then redox
observations with concentrated H ₂ SO ₄			• black solid • yellow solid • effervescence

(i) Complete Table 1.2. [4]

(ii) Suggest an identity for the species that produces each observation in the reaction of NaI with concentrated H₂SO₄.

black solid

yellow solid

effervescence

[2]

(d) Table 1.3 gives some information about MgCl₂ and SiCl₄.

Table 1.3

	MgCl ₂	SiCl ₄
electrical conductivity when liquid	conducts	does not conduct
observation when added to water	dissolves	vigorous reaction

(i) Explain the difference between the electrical conductivity of liquid MgCl₂ and of liquid SiCl₄. Refer to bonding and relevant particles in your answer.

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.....

..... [2]

(ii) Suggest the pH of the solutions that form when each chloride is added to water.

MgCl₂ SiCl₄

③

[2]