WEIRD CHEMIST

Hydrolysis Reactions

Chapter: p-Block Elements

DPP – 05

Topic: Hydrolysis (Halides & Xe Fluorides) **Questions:** 10 Questions **Exam:** JEE / NEET

▶ Hydrolysis of Covalent Halides — Groups 13 & 14

Q1. In the trivalent state, the covalent trichloride MCl_3 of a Group 13 element is hydrolysed in water to give the $[M(OH)_4]^-$ ion. The geometry of this ion and the hybridisation of the central atom M are respectively

(1) trigonal planar; sp^2
(2) tetrahedral; sp^3
(3) square planar; dsp^2
(4) trigonal bipyramidal; sp^3d

Q2. When MCl_3 (a covalent Group 13 trichloride) undergoes hydrolysis to form $[M(OH)_4]^-$, the hybridisation of M changes from

(1) sp^3 to sp^2
(2) sp^2 to sp^3
(3) sp to sp^2
(4) sp^3 to sp^3d

Q3. Among the Group 14 tetrachlorides, CCl_4 resists hydrolysis whereas $SiCl_4$ is readily hydrolysed by water. The correct reason is

(1) C has vacant d orbitals while Si does not
(2) C has no vacant d orbitals to accept the lone pair from water, whereas Si has accessible vacant $3d$ orbitals
(3) CCl_4 is ionic while $SiCl_4$ is covalent
(4) Si is more electronegative than C

Q4. The first step in the hydrolysis of $SiCl_4$ involves

(1) donation of a lone pair by Si to the water molecule
(2) acceptance of a lone pair from the oxygen of water into the vacant d orbitals of Si
(3) complete dissociation of $SiCl_4$ into Si^{4+} and Cl^- ions
(4) transfer of a hydride ion from water to Si

Q5. Following the same mechanism as $SiCl_4$, complete hydrolysis of a Group 14 tetrachloride MCl_4 (M = Si, Ge, Sn) ultimately yields

(1) $M(OH)_4$ and HCl
(2) MO_2 and H_2
(3) MH_4 and Cl_2
(4) MCl_2 and Cl_2

▶ TYPE 1 : Analytical Ability

Q6. Consider the hydrolysis of XeF_4:

$$6\,XeF_4 + 12\,H_2O \longrightarrow 4\,Xe + 2\,XeO_3 + 24\,HF + 3\,O_2$$

Tracking the oxidation state of xenon ($+4$ in XeF_4), the correct inference is

(1) Xe is only reduced, from $+4$ to 0
(2) Xe is only oxidised, from $+4$ to $+6$
(3) Xe disproportionates: part reduced to 0 and part oxidised to $+6$
(4) Xe stays in the $+4$ state in all products

▶ TYPE 2 : Conceptual Clarity

Q7. Complete hydrolysis of XeF_6 gives XeO_3, whereas its partial hydrolysis gives

(1) only Xe and O_2
(2) the oxyfluorides $XeOF_4$ and XeO_2F_2
(3) XeF_4 and HF
(4) XeO_3 and O_2

▶ TYPE 3 : Application Skills

Q8. Using the usual oxidation numbers of O (-2) and F (-1), the oxidation state of xenon in $XeOF_4$, XeO_2F_2 and XeO_3 is respectively

(1) $+4,\ +4,\ +6$
(2) $+6,\ +6,\ +6$
(3) $+6,\ +4,\ +6$
(4) $+2,\ +4,\ +6$

▶ TYPE 4 : Diagram-Based Visual Literacy

Q9. Molecule ($XeOF_4$) has the shape and hybridisation

(1) square planar; dsp^2
(2) square pyramidal; sp^3d^2
(3) trigonal bipyramidal; sp^3d
(4) octahedral; sp^3d^2

▶ TYPE 5 : Time Management & Strategic Thinking

Q10. Pick the INCORRECT statement in one read:

(1) XeO_3 is a colourless explosive solid with a pyramidal shape
(2) $XeOF_4$ is a colourless volatile liquid with a square pyramidal shape
(3) Partial hydrolysis of XeF_6 can give $XeOF_4$
(4) Complete hydrolysis of XeF_4 gives XeO_3 as the only xenon-bearing product

— End of question paper. Answers & solutions are provided separately. —