Solutions

S1. Ans.(c)

Oxygen shows –2, –1, +1 and +2 oxidation states

Selenium shows –2, +2, +4 and +6 oxidation states

Tellurium shows –2, +2, +4 and +6 oxidation states

Polonium shows +2 and +4 oxidation states

S2. Ans.(d)

Statement I is correct, because boiling point of hydrides of group 16 follows the order $H_2O > H_2Te > H_2Se > H_2S$.

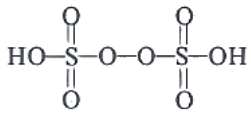
Statement II due to intermolecular H-bonding H_2O shows higher boiling point than respective hydrides of group 16.

(Both Statement are true)

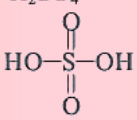
Order from H_2Te to H_2S is due to decreasing molar mass.

S3. Ans. (a)

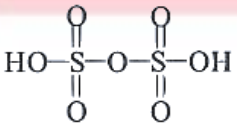
A ⟶ Peroxodisulphuric acid



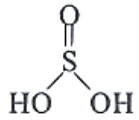
B ⟶ Sulphuric acid H_2SO_4



C ⟶ Pyrosulphuric acid $H_2S_2O_7$



D ⟶ Sulphurous acid H_2SO_3



S4. Ans. (c)

$4NH_3 + 5O_2(\text{from air}) \xrightarrow[500\ K,9\ bar]{Pt} 4NO + 6H_2O$

$2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g)$

$3NO_2(g) + H_2O(l) \longrightarrow 2HNO_3(aq) + NO(g)$

This is industrial method of preparation of nitric acid.

S5. Ans. (b)

Compound	Boiling point (K)
H_2O	373
H_2S	213
H_2Se	232
H_2Te	269

- The boiling points of these hybrids not exactly with increase in molar mass.
- H_2O has maximum boiling point due to intermolecular hydrogen bonding.

S6. Ans.(a)

Noble gases have weak dispersion forces so they have low melting and boiling points.

S7. Ans.(d)

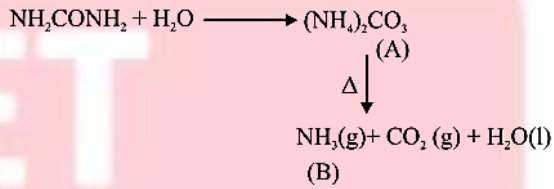
The correct order of acidic strength is

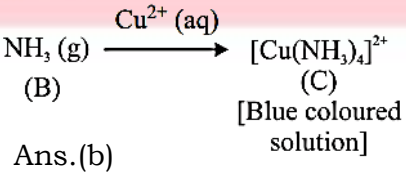
HI > HBr > HCl > HF

S8. Ans.(a)

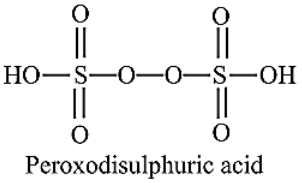
Order of pK_a is $H_2O > H_2S > H_2Se > H_2Te$

S9. Ans.(a)





S10. Ans.(b)



Peroxodisulphuric acid $H_2S_2O_8$, has –O–O– linkage

S11. Ans.(d)

Concentrated sulphuric acid is a strong dehydrating agent and it readily dehydrate carbohydrates into carbon

$$2C_{12}H_{22}O_{11} + conc.H_2SO_4(conc) \rightarrow 12C + 11H_2O$$

The reaction of concentrated sulphuric acid with carbohydrates ($C_{12}H_{22}O_{11}$) is an example of dehydration.

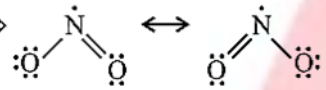
S12. Ans.(b)

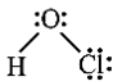
Reaction of F_2 with H_2O gives products HF(aq) and O_2(g) in which fluorine oxidizes water into oxygen that does not come under hydrolysis type reaction.

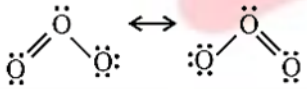
S13. Ans.(c)

N_2O has linear, unsymmetrical structure

$N_2O \Rightarrow :N\equiv N-\ddot{O}: \leftrightarrow \ddot{N}=N=O$

$NO_2 \Rightarrow$ 

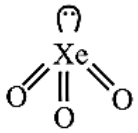
$HOCl \Rightarrow$ 

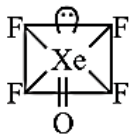
$O_3 \Rightarrow$ 

S14. Ans.(a)

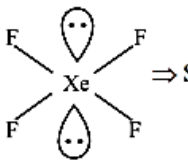
XeF_2 :  Linear

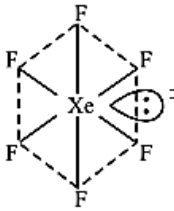
XeF_4 :  Sqaure planar

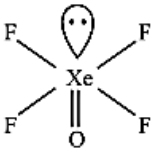
XeO_3 :  Pyramidal

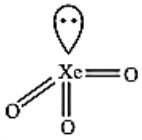
$XeOF_4$:  Square pyramidal

S15. Ans.(b)

A. XeF_4 :  $\Rightarrow$ Square Planar

B. XeF_6 :  $\Rightarrow$ Distorted octahedral

C. $XeOF_4$:  $\Rightarrow$ Square pyramidal

D. XeO_3 :  $\Rightarrow$ Pyramidal

S16. Ans.(c)

Thermal stability order for H_2E decrease down the group because H–E bond energy decreases on going down the group.

∴ Order of stability would be :

$H_2Po < H_2Te < H_2Se < H_2S < H_2O$

S17. Ans.(d)

(a) Pure nitrogen : Sodium azide or Barium azide
(b) Haber : Ammonia
(c) Contact processs : Sulphuric acid
(d) Deacon's process : Chlorine

S18. Ans.(a)

$\longleftarrow$

$\overset{+5}{H}\ \overset{+2}{N}\ \overset{0}{O_3},\ \overset{-3}{N}\ O, N_2,\ N\ H_4Cl$

Hence, the correct option is (a).

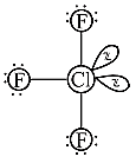
S19. Ans.(a)

All halogens show +ve and –ve oxidation state while F show –ve oxidation state.

Due to high electronegativity and small size, F forms only one oxoacid, HOF known as Fluoric (I) acid. Oxidation number of F is +1 in HOF.

S20. Ans.(b)

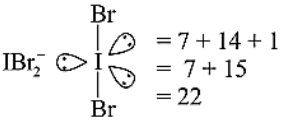
The structure of ClF_3 is

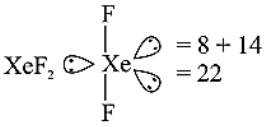


The number of lone pair of electrons on central Cl is 2.

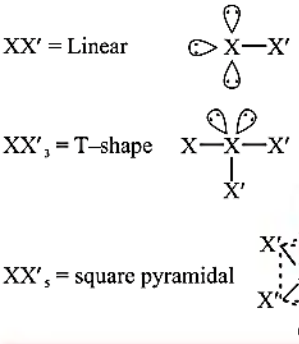
S21. Ans.(a)

S22. Ans.(d)

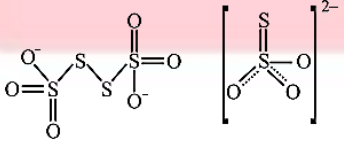




S23. Ans.(c)



S24. Ans.(c)



S25. Ans.(c)

KO_2 absorb CO_2 and release oxygen.

$2KO_2 + CO_2 \rightarrow K_2CO_3 + 3/2O_2$

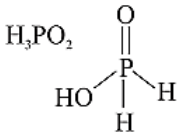
S26. Ans.(c)

Cl_2 : Have highest bond dissociation enthalpy because $Cl_2 > Br_2 > F_2 > I_2$ bond dissociation enthalpy.

HF : Have highest bond dissociation enthalpy because

Bond dissociation enthalpy $\propto \frac{1}{\text{Bond length}}$

S27. Ans.(c)



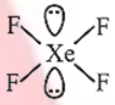
Strong reducing behaviour of H_3PO_2 is due to presence of 1 –OH group and 2 P–H group.

S28. Ans.(d)

Fluorine is the most electronegative element of the periodic table. Therefore, it can oxidise water to oxygen.

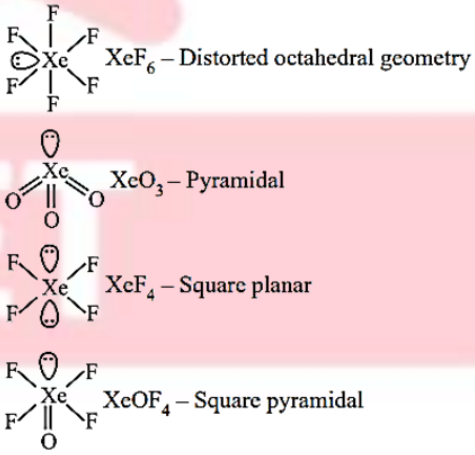
$2F_2 + 2H_2O \rightarrow 4HF + O_2$.

S29. Ans.(c)



XeF_4 is a AB^4L^2 type molecule with 4 – bond pair and 2 lone pair. Octahedral geometry and shape is square planar with hybridization sp^3d^2.

S30. Ans.(b)



S31. Ans.(c)

Bond dissociation energy of halogen family decreases down the group as the size of the atom increases. The bond dissociation energy of fluorine is, however, lower than that of chlorine and bromine because of inter electronic repulsions present in the small atom of fluorine.

Hence bond energy decreases in the order:

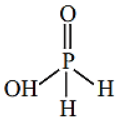
$Cl_2 > Br_2 > F_2 > I_2$

S32. Ans.(c)

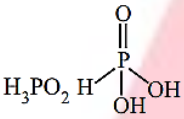
Correct order of acidity among oxo – acids of Cl is $HClO_4$ > $HClO_3$ > $HClO_2$ > HClO because the oxidation number of central atom increases, acidic nature increases.

S33. Ans.(b)

Phosphinic acid (Hypophosphorous acid) is a monoprotic acid (H_3PO_3).



While phosphonic acid – H_3PO_2



is a diprotic acid.

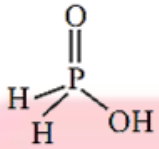
S34. Ans.(b)

$$Cu + HNO_3(conc.) \rightarrow \underset{(Brown\ gas)}{Cu(NO_3)_2} + 2NO_2 + H_2O$$

With HNO_3 (dil) gives NO gas.

S35. Ans.(b)

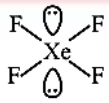
In H_3PO_2, presence of 2H makes H_3PO_2 a reducing agent.



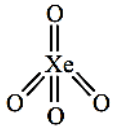
S36. Ans.(c)

Fluorine forms strongest hydrogen bond among all halogens.

S37. Ans.(a)



XeF_4 → Square planar



XeO_4 → Tetrahedral structure non-identical geometry.

S38. Ans.(c)

OF_2 (oxygen difluoride) is a fluoride of oxygen because fluorine is more electronegative than oxygen.

S39. Ans.(b)

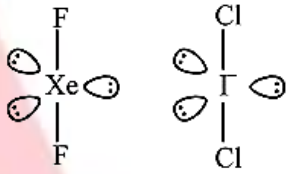
NO_2 is not used as a food preservative.

S40. Ans.(d)

Order for acidity is H_2S < H_2Se < H_2Te, as we move down the group atomic radius of atom increases because of which size also increases and bond dissociation enthalpy decreases and such atoms can easily furnish H^+ in aqueous medium.

S41. Ans.(b)

XeF_2 is isostructural with ICl_2^-



Sp^3d hybridization and linear geometry

S42. Ans.(d)

Heating of ammonium dichromate yields nitrogen:

It is a laboratory preparation for nitrogen.

$$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} N_2 + Cr_2O_3 + H_2O$$

$$2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$$

$$Zn(ClO_3)_2 \xrightarrow{\Delta} ZnCl_2 + 3O_2$$

$$K_2Cr_2O_7 \xrightarrow{\Delta} 2K_2CrO_4 + Cr_2O_2 + \frac{3}{2}O_2$$

S43. Ans.(c)

$HClO_4$ is the strongest acid, as it has greater number of 'O' atoms, so more e⁻s will be pulled away from O–H bond and more this bond will be weakened. Between H_2SO_4 and $HClO_4$, $HClO_4$ is strong because perchlorate ion formed by removal of hydrogen atom is more stabilized than sulphate ion as negative charge is more dispersed in perchlorate ion.