The p-Block Elements (Part – B)

1. Match List I with List II:

	List I (Oxoacids of sulphur)		List II (Bonds)
A.	Peroxodisulphuric acid	1.	Two S-OH, Four S=O, One S-O-S
B.	Sulphuric acid	2.	Two S-OH, One S=O
C.	Pyrosulphuric acid	3.	Two S-OH, Four S=O, One S-O-O-S
D.	Sulphurous acid	4.	Two S-OH, Two S=O

Choose the correct answer from the options given below: **(2023)**

(a) A-3, B-4, C-1, D-2
(b) A-1, B-3, C-4, D-2
(c) A-3, B-4, C-2, D-1
(d) A-1, B-3, C-2, D-4

2. Which of the following reactions is part of the large-scale industrial preparation of nitric acid? **(2022)**

(a) $Cu(NO_3)_2 + 2NO_2 + 2H_2O \xrightarrow[500\ K,9\ bar]{Pt} 4HNO_3 + Cu$

(b) $NaNO_3 + H_2SO_4 \xrightarrow[500\ K,9\ bar]{Pt} NaHSO_4 + HNO_3$

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

(d) $4HPO_3 + 2N_2O_5 \xrightarrow[500\ K,9\ bar]{Pt} 4HNO_3 + P_4O_{10}$

3. Given below are two statements

Statement I: The boiling points of the following hydrides of group 16 elements increases in the order-
$H_2O < H_2S < H_2Se < H_2Te$

Statement II: The boiling points of these hydrides increase with increase in molar mass.

In the light of the above statements, choose the most appropriate answer from the options given below: **(2022)**

(a) Both Statement I and Statement II are correct.
(b) Both Statement I and Statement II are incorrect.
(c) Statement I is correct but Statement II is incorrect.
(d) Statement I is incorrect but Statement II is correct.

4. Noble gases are named because of their inertness towards reactivity. Identify an **incorrect** statement about them. **(2021)**

(a) Noble gases have very high melting and boiling points
(b) Noble gases have weak dispersion forces
(c) Noble gases have large positive values of electron gain enthalpy
(d) Noble gases are sparingly soluble in water

5. **Statement-I :** Acid strength increases in the order given as HF << HCl << HBr << HI.
Statement-II : As the size of the elements F, Cl, Br, I increases down the group, the bond strength of HF, HCl, HBr and HI decreases and so the acid strength increases.

In the light of the above statements, choose the correct answer from the options given below. **(2021)**

(a) Both statement I and statement II are false
(b) Statement I in correct but statement II is false
(c) Statement I is incorrect but statement II is true
(d) Both statement I and statement II are true

6. In which one of the following arrangements the given sequence is **not** strictly according to the properties indicated against it? **(2021)**

(a) $H_2O < H_2S < H_2Se < H_2Te$: Increasing pK_a values
(b) $NH_3 < PH_3 < AsH_3 < SbH_3$: Increasing acidic character
(c) $CO_2 < SiO_2 < SnO_2 < PbO_2$: Increasing oxidizing power

(d) HF < HCl < HBr < HI : Increasing acidic strength

7. Urea reacts with water to form A which will decompose to form B. B when passed through Cu^{2+} (aq), deep blue colour solution C is formed. What is the formula of C from the following? **(2020)**
   (a) $[Cu(NH_3)_4]^{2+}$
   (b) $Cu(OH)_2$
   (c) $CuCO_3 \cdot Cu(OH)_2$
   (d) $CuSO_4$

8. Which of the following oxoacid of sulphur has – O – O – linkage? **(2020)**
   (a) H_2SO_4, sulphuric acid
   (b) $H_2S_2O_8$, peroxodisulphuric acid
   (c) $H_2S_2O_7$, pyrosulphuric acid
   (d) H_2SO_3, sulphorous acid

9. The reaction of concentrated sulphuric acid with carbohydrates ($C_{12}H_{22}O_{11}$) is an example of **(2020 Covid Re-NEET)**
   (a) Oxidation
   (b) Reduction
   (c) Sulphonation
   (d) Dehydration

10. Which one of the following reactions does not come under hydrolysis type reaction? **(2020 Covid Re-NEET)**
   (a) $Li_3N(s) + 3H_2O(l) \rightarrow NH_3(s) + 3LiOH(aq)$
   (b) $2F_2(g) + 2H_2O(l) \rightarrow 4HF(aq) + O_2(g)$
   (c) $P_4P_{10}(s) + 6H_2O(l) \rightarrow 4H_3PO_4(aq)$
   (d) $SiCl_4(l) + 2H_2O(l) \rightarrow SiO_2(s) + 4HCl(aq)$

11. Among the compounds shown below which one revealed a linear structure? **(2020 Covid Re-NEET)**
   (a) HOCl
   (b) O_3
   (c) N_2O
   (d) NO_2

12. Match the compounds of Xe in column I with the molecular structure in column II. **(2020 Covid Re-NEET)**

	Column I		**Column II**
A.	XeF_2	(i)	Square planar
B.	XeF_4	(ii)	Linear
C.	XeO_3	(iii)	Square pyramidal
D.	$XeOF_4$	(iv)	Pyramidal

   (a) A-(ii), B-(i), C-(iv), D-(iii)
   (b) A-(ii), B-(i0, C-(iii), D-(iv)
   (c) A-(ii), B-(iv), C-(iii), D-(i)
   (d) A-(ii), B-(iii), C-(i), D-(iv)

13. Match the Xenon compounds in Column-I with its structure in Column-II and assign the correct code: **(2019)**

	Column I		**Column II**
A.	XeF_4	(i)	Pyramidal
B.	XeF_6	(ii)	Square planar
C.	$XeOF_4$	(iii)	Distorted octahedral
D.	XeO_3	(iv)	Square pyramidal

   Code :

	A	B	C	D
(a)	(i)	(ii)	(iii)	(iv)
(b)	(ii)	(iii)	(iv)	(i)
(c)	(ii)	(iii)	(i)	(iv)
(d)	(iii)	(iv)	(i)	(ii)

14. Which is the correct thermal stability order for H_2E (E = O, S, Se, Te and Po)? **(2019)**
   (a) $H_2S < H_2O < H_2Se < H_2Te < H_2Po$
   (b) $H_2O < H_2S < H_2Se < H_2Te < H_2Po$
   (c) $H_2Po < H_2Te < H_2Se < H_2S < H_2O$
   (d) $H_2Se < H_2Te < H_2Po < H_2O < H_2S$

15. Match the following: **(2019)**

	Column I		**Column II**
A.	Pure nitrogen	(i)	Chlorine
B.	Haber process	(ii)	Sulphuric acid
C.	Contact process	(iii)	Ammonia
D.	Deacon's process	(iv)	Sodium azide or Barium azide

   Which of the following is the correct option?

	A	B	C	D
(a)	(i)	(ii)	(iii)	(iv)
(b)	(ii)	(iv)	(i)	(iii)
(c)	(iii)	(iv)	(ii)	(i)
(d)	(iv)	(iii)	(ii)	(i)

16. The correct order of N-compounds in its decreasing order of oxidation states is **(2018)**
   (a) HNO_3, NO, N_2, NH_4Cl
   (b) HNO_3, NO, NH_4Cl, N_2
   (c) NH_4Cl, N_2, NO, HNO_3
   (d) HNO_3, NH_4Cl, NO, N_2

17. Which of the following statements is not true for halogens? **(2018)**
   (a) All form monobasic oxyacids

(b) All are oxidizing agents
(c) Chlorine has the highest electron-gain enthalpy
(d) All but fluorine show positive oxidation states

18. In thew structure of ClF_3, the number of lone pair of electrons on central atom 'Cl' is **(2018)**
(a) One
(b) Two
(c) Three
(d) Four

19. Which oxide of nitrogen is not a common pollutant introduced into the atmosphere both due to natural and human activity? **(2018)**
(a) N_2O_5
(b) NO_2
(c) NO
(d) N_2O

20. Which of the following pairs of compounds is isoelectronic and isostructural? **(2017-Delhi)**
(a) IF_3, XeF_2
(b) $BeCl_2, XeF_2$
(c) Tel_2, XeF_2
(d) IBr_2^-, XeF_2

21. Match the interhalogen compounds of column I with the geometry in column II and assign the correct code: **(2017-Delhi)**

	Column I		**Column II**
A.	XX'	(i)	T-shape
B.	XX_3'	(ii)	Pentagonal bipyramidal
C.	XX_5'	(iii)	Linear
D.	XX_7'	(iv)	Square-pyramidal
		(v)	Tetrahedral

Code:

	A	B	C	D
(a)	(iv)	(iii)	(ii)	(i)
(b)	(iii)	(iv)	(i)	(ii)
(c)	(iii)	(i)	(iv)	(ii)
(d)	(v)	(iv)	(iii)	(ii)

22. In which pair of ions both the species contain S–S bond? **(2017-Delhi)**
(a) $S_4O_6^{2-}, S_2O_7^{2-}$
(b) $S_2O_7^{2-}, S_2O_3^{2-}$
(c) $S_4O_6^{2-}, S_2O_3^{2-}$
(d) $S_2O_7^{2-}, S_2O_8^{2-}$

23. Which of the following absorbs carbon dioxide and releases oxygen? **(2017-Gujarat)**
(a) K_2O
(b) CaO
(c) KO_2
(d) KOH

24. Which of the following pairs shows highest bond dissociation enthalpy among halogens and lowest bond dissociation enthalpy among hydrogen halides? **(2017-Gujarat)**
(a) I_2, HI
(b) F_2, HF
(c) Cl_2, HF
(d) Br_2, HBr

25. Strong reducing behaviour of H_3PO_2 is due to : **(2017-Gujarat)**
(a) Low coordination number of P
(b) Low oxidation state of P
(c) Presence of one – OH group and two P – H bonds
(d) Presence of two – OH groups and one P – H bond

26. Among halogens, the one which can oxidise water to oxygen is : **(2017-Gujarat)**
(a) Iodine
(b) chlorine
(c) Bromine
(d) Fluorine

27. The correct geometry and hybridization for XeF_4 are : **(2016-II)**
(a) Planar triangle, sp^3d^3
(b) Square planar, sp^3d^2
(c) Octahedral, sp^3d^2
(d) Trigonal bipyramidal, sp^3d

28. Match the compound given in column I with the hybridization and shape given in column II and mark the correct option. **(2016-I)**

	Column I		**Column II**
A.	XeF_6	(i)	Distorted octahedral
B.	XeO_3	(ii)	Square planar
C.	$XeOF_4$	(iii)	Pyramidal
D.	XeF_4	(iv)	Square pyramidal

Code:

	A	B	C	D
(a)	(iv)	(i)	(ii)	(iii)

(b) (i) (iii) (iv) (ii)
(c) (i) (ii) (iv) (iii)
(d) (iv) (iii) (i) (ii)

29. Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules? **(2016-I)**
(a) $F_2 > Cl_2 > Br_2 > I_2$
(b) $I_2 > Br_2 > Cl_2 > F_2$
(c) $Cl_2 > Br_2 > F_2 > I_2$
(d) $Br_2 > I_2 > F_2 > Cl_2$

30. Among the following, the correct order of acidity is: **(2016-I)**
(a) $HClO_4 < HClO_2 < HClO < HClO_3$
(b) $HClO_3 < HClO_4 < HClO_2 < HClO$
(c) $HClO < HClO_2 < HClO_3 < HClO_4$
(d) $HClO_2 < HClO < HClO_3 < HClO_4$

31. Which is the correct statement for the given acids? **(2016-I)**
(a) Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid
(b) Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid
(c) Both are diprotic acids
(d) Both are triprotic acids

32. When copper is heated with conc. HNO_3 it produces: **(2016-I)**
(a) $Cu(NO_3)_2$ and N_2O
(b) $Cu(NO_3)_2$ and NO_2
(c) $Cu(NO_3)_2$ and NO
(d) $Cu(NO_3)_2$, NO and NO_2

33. Strong reducing behaviour of H_3PO_2 is due to : **(2015 Re)**
(a) Presence of two –OH groups and one P–H bond
(b) Presence of one –OH group and two P–H bonds
(c) High electron gain enthalpy of phosphorus
(d) High oxidation state of phosphorus

34. The variation of the boiling points of the hydrogen halides is in the order HF > HI > HBr > HCl. What explains the higher boiling point of hydrogen fluoride? **(2015 Re)**
(a) The effect of nuclear shielding is much reduced in fluorine which polarizes the HF molecule
(b) The electronegativity of fluorine is much higher than for other elements in the group
(c) There is strong hydrogen bonding between HF molecules
(d) The bond energy of HF molecules is greater than in other hydrogen halides

35. In which of the following pairs, both the species are not isostructural? **(2015 Re)**
(a) XeF_4, XeO_4
(b) $SiCl_4$, PCl_4^+
(c) Diamond, silicon carbode
(d) NH_3, PH_3

36. Which of the statements given below is incorrect? **(2015 Re)**
(a) O_3 molecule is bent
(b) ONF is isoelectronic with O_2N^-
(c) OF_2 is an oxide of fluorine
(d) Cl_2O_7 is an anhydride of perchloric acid

37. Nitrogen dioxide and sulphur dioxide have some properties in common. Which property is shown by one of these compounds, but not by the other? **(2015)**
(a) Is soluble in water
(b) Is used as a food preservtive
(c) Forms 'acid-rain'
(d) Is a reducing agent

38. Acidity of diprotic acids in aqueous solutions increases in the order: **(2014)**
(a) $H_2Se < H_2S < H_2Te$
(b) $H_2Te < H_2S < H_2Se$
(c) $H_2Se < H_2Te < H_2S$
(d) $H_2S < H_2Se < H_2Te$

39. XeF_2 is isostructural with: **(2013)**
(a) TeF_2
(b) ICl_2^-
(c) $SbCl_3$
(d) $BaCl_2$

40. Which of the following does not give oxygen on heating? **(2013)**
(a) $KClO_3$
(b) $Zn(ClO_3)_2$
(c) $K_2Cr_2O_7$
(d) $(NH_4)_2Cr_2O_7$

41. Which is the strongest acid in the following? **(2013)**
(a) H_2SO_4
(b) $HClO_3$
(c) $HClO_4$
(d) H_2SO_3

Answer Key

S1. Ans. (a)

S2. Ans. (c)

S3. Ans. (b)

S4. Ans. (a)

S5. Ans. (d)

S6. Ans. (a)

S7. Ans. (a)

S8. Ans. (b)

S9. Ans. (d)

S10. Ans. (b)

S11. Ans. (c)

S12. Ans. (a)

S13. Ans. (b)

S14. Ans. (c)

S15. Ans. (d)

S16. Ans. (a)

S17. Ans. (a)

S18. Ans. (b)

S19. Ans. (a)

S20. Ans. (d)

S21. Ans. (c)

S22. Ans. (c)

S23. Ans. (c)

S24. Ans. (c)

S25. Ans. (c)

S26. Ans. (d)

S27. Ans. (c)

S28. Ans. (b)

S29. Ans. (c)

S30. Ans. (c)

S31. Ans. (b)

S32. Ans. (b)

S33. Ans. (b)

S34. Ans. (c)

S35. Ans. (a)

S36. Ans. (c)

S37. Ans. (b)

S38. Ans. (d)

S39. Ans. (b)

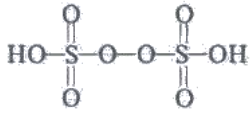
S40. Ans. (d)

S41. Ans. (c)

Solutions

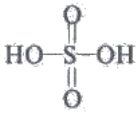
S1. Ans. (a)

A → Peroxodisulphuric acid

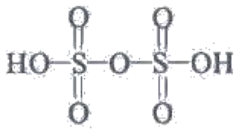


B → Sulphuric acid

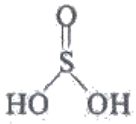
H_2SO_4



C → Pyrosulphuric acid $H_2S_2O_7$



D → Sulphurous acid H_2SO_3



S2. 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.

S3. 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.

S4. Ans.(a)

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

S5. Ans.(d)

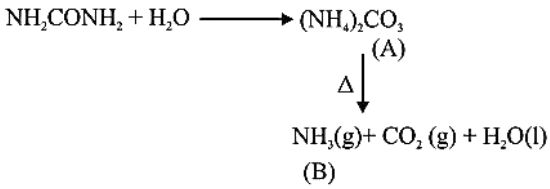
The correct order of acidic strength is

HI > HBr > HCl > HF

S6. Ans.(a)

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

S7. Ans.(a)

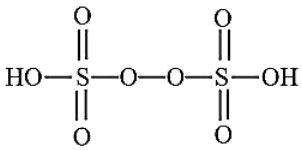


$NH_3(g) + Cu^{2+}(aq) \longrightarrow [Cu(NH_3)_4]^{2+}$

(B) (C)

[Blue coloured solution]

S8. Ans.(b)



Peroxodisulphuric acid

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

S9. 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.

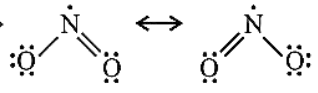
S10. Ans.(b)

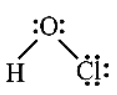
Reaction of F_2 with H_2O gives products HF(aq) and O_2(g) in which fluorine oxidizes water into oxygen that does not come under hydrolysis type reaction.

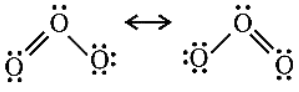
S11. Ans.(c)

N_2O has linear, unsymmetrical structure

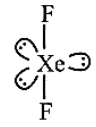
$N_2O \Rightarrow :N\equiv N-\ddot{O}: \leftrightarrow \ddot{N}=N=O$

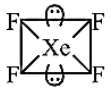
$NO_2 \Rightarrow$ 

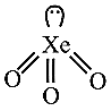
$HOCl \Rightarrow$ 

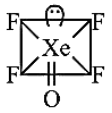
$O_3 \Rightarrow$ 

S12. Ans.(a)

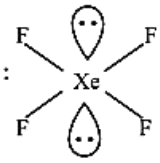
XeF_2 :  Linear

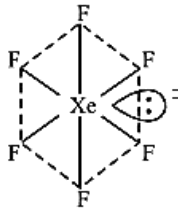
XeF_4 :  Sqaure planar

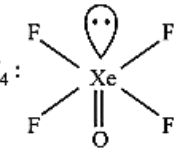
XeO_3 :  Pyramidal

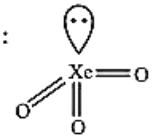
$XeOF_4$:  Square pyramidal

S13. 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

S14. Ans.(c)

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

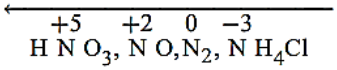
$\therefore$ Order of stability would be :

$H_2Po < H_2Te < H_2Se < H_2S < H_2O$

S15. Ans.(d)

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

S16. Ans.(a)



Hence, the correct option is (a).

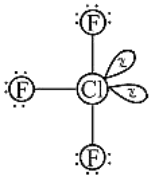
S17. Ans.(a)

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.

S18. Ans.(b)

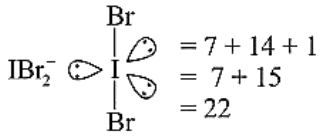
The structure of ClF_3 is

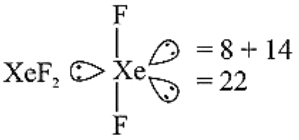


The number of lone pair of electrons on central Cl is 2.

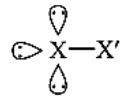
S19. Ans.(a)

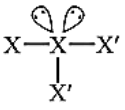
S20. Ans.(d)

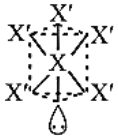




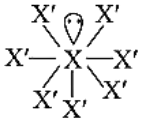
S21. Ans.(c)

XX' = Linear 

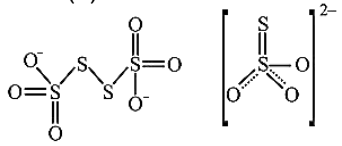
XX'_3 = T–shape 

XX'_5 = square pyramidal 

XX'_7 = Pentagonal bipyramidal



S22. Ans.(c)



S23. Ans.(c)

KO_2 absorb CO_2 and release oxygen.

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

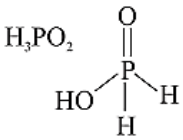
S24. Ans.(c)

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

S25. Ans.(c)



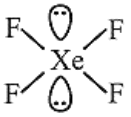
Strong reducing behaviour of H_3PO_2 is due to presence of 1 –OH group and 2 P–H group.

S26. Ans.(d)

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

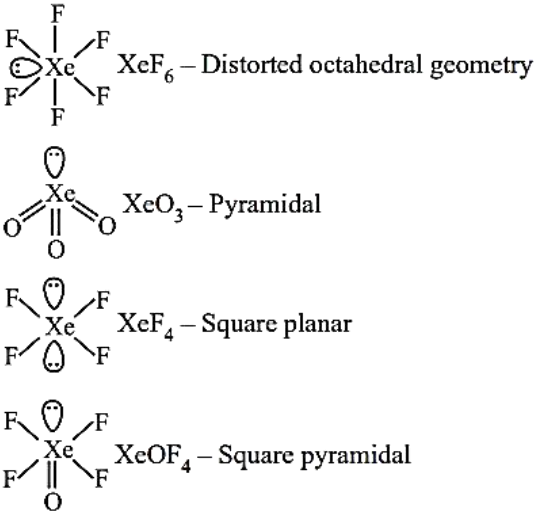
$2F_2 + 2H_2O \rightarrow 4HF + O_2$.

S27. 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.

S28. Ans.(b)



S29. 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:

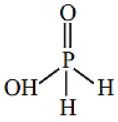
$Cl_2 > Br_2 > F_2 > I_2$

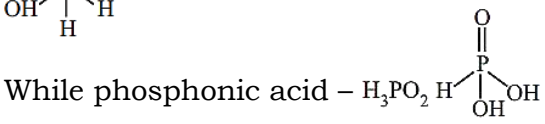
S30. Ans.(c)

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.

S31. Ans.(b)

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



While phosphonic acid – 

is a diprotic acid.

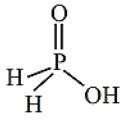
S32. Ans.(b)

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

With HNO_3 (dil) gives NO gas.

S33. Ans.(b)

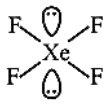
In H_3PO_2, presence of 2H makes H_3PO_2 a reducing agent.



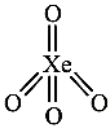
S34. Ans.(c)

Fluorine forms strongest hydrogen bond among all halogens.

S35. Ans.(a)



$XeF_4 \rightarrow$ Square planar



$XeO_4 \rightarrow$ Tetrahedral structure non-identical geometry.

S36. Ans.(c)

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

S37. Ans.(b)

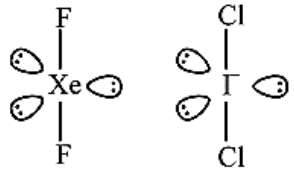
NO_2 is not used as a food preservative.

S38. 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.

S39. Ans.(b)

XeF_2 is isostructural with ICl_2^-



Sp^3d hybridization and linear geometry

S40. Ans.(d)

Heating of ammonium dichromate yields nitrogen:

It is a laboratory preparation for nitrogen.

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

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

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

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

S41. 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.