Exercise-1

Marked Questions may have for Revision Questions.

OBJECTIVE QUESTIONS

Section (A) : Physical and Chemical properties of Group 15th elements

A-1. Which one of the following does not show allotropy ?
(1*) Nitrogen (2) Phosphorus (3) Arsenic (4) Antimony

A-2. In group 15, the melting points of the elements :
(1) increase regularly on moving down the group.
(2) decrease regularly on moving down the group.
(3) first decrease upto As and then increase to Bi.
(4*) first increase from N to As and then decrease to Bi.

A-3. Which of the following statements is incorrect for the group 15^{th} elements ?
(1) Metallic character increases down the group with decrease in ionisation enthalpy and increase in atomic size.
(2) The stability of +5 oxidation state decreases and that of +3 state increases down the group on account of inert pair effect.
(3) The tendency to undergoes –3 oxidation state decreases down the group due to increase in size and metallic character.
(4*) In case of phosphorus compounds having +4 oxidation state disproportionates into +5 and +3 both in acid and alkali.

A-4. The hydrides of group 15 elements act as :
(1) lewis acids (2*) lewis bases (3) both (4) none

A-5. Nitrogen shows different oxidation states in the range :
(1) 0 to 5 (2*) – 3 to + 5 (3) – 5 to + 3 (4) – 5 to + 3

A-6. Single N-N bond is weaker than the single P-P bond . This is because of :
(1) larger N-N bond length in comparision to P-P bond length .
(2*) high interelectronic repulsion of the non-bonding electrons, owing to the small N-N bond length in comparision to that in P-P single bond .
(3) higher electronegetivity of N in comparision to P.
(4) samaller atomic size of N as compared to that of P.

A-7. The basic strength of the hydrides of group 15 elements :
(1*) decreases on moving down the group (2) increases on moving down the group
(3) first decreases upto AsH_3 and then increases (4) first increases upto AsH_3 and then decreases

A-8. What causes nitrogen to be chemically inert ?
(1) Multiple bond formation in the molecule (2) Absence of bond polarity
(3) Short internuclear distance (4*) High bond energy

A-9. Among the members of group 15 (N, P, As, Sb and Bi), which of the following properties show an increase as we go down from nitrogen to bismuth
(1) Stability of +5 oxidation state (2*) Reducing character of hydrides
(3) Electronegativity (4) Acidic nature of the pentoxide

A-10. Which of the following tendencies remains unchanged on going down in the nitrogen family ?
(1*) Highest oxidation state (2) Non-metallic character
(3) Stability of hydrides (4) Physical state

A-11. The oxidation number of sulphur in S_8, S_2F_2 and H_2S respectively are : **[JEE 1999, 2]**
(1*) 0, + 1 and – 2 (2) + 2, + 1 and – 2 (3) 0, + 1 and + 2 (4) – 2, + 1 and – 2

A-12. Red and white phosphorus will differ but not in :
(1) smell (2) solubility in $CHCl_3$
(3) exhibiting phosphorescence (4*) reaction with concentrated HNO_3

A-13. Which of the following is least reactive ?
(1) White phosphorus (2) Yellow phosphorus (3) Red phosphorus (4*) Black phosphorus

A-14. Which of the following oxides is the most acidic?
(1*) N_2O_5 (2) P_2O_5 (3) As_2O_5 (4) Sb_2O_5

A-15. Which of the following oxides is amphoteric in nature ?
(1) N_2O_3 (2) P_4O_6 (3*) Sb_4O_6 (4) Bi_2O_3

A-16. In case of nitrogen, NCl_3 is possible but not NCl_5 while in case of phosphorous, PCl_3 as well as PCl_5 are possible. It is due to
(1*) Availability of vacant d-orbital in P but not in N
(2) Lower electronegativity of P than N
(3) Lower tendency of H bond formation in P than N
(4) Occurrence of P in solid while N in gaseous state at room temperature.

A-17. The P-P-P bond angle in white phosphorus is close to :
(1) 120º (2) 109º28' (3) 90º (4*) 60º

Section (B) : Compounds of Nitrogen and phosphorus

B-1. Thermal decomposition of ammonium dichromate yields :
veksfu;e MkbØksesV ds rkih; fo?kVu }kjk çkIr gksrk gS %
(1) NH_3 (2*) N_2 (3) NO_2 (4) O_2

B-2. In the manufacture of ammonia by Haber's process, the catalyst used is :
(1) oxide of iron only (2) oxide of iron and K_2O
(3) oxide of iron ,K_2O and Al_2O_3 (4) oxide of vanadium only

B-3. N_2O is formed :
(1) by heating NH_4NO_2 (2) by heating NH_4NO_3
(3) by heating $CsNO_3$ (4) by heating $Ca(NO_3)_2$

B-4. Which of the following metals gives N_2O gas with dilute HNO_3 ?
(1*) Zn (2) Cu (3) Au (4) Pb

B-5. Which of the following will combine with Fe(II) ion to form a brown complex compound ?
(1) N_2O (2*) NO (3) N_2O_3 (4) NO_2

B-6. NO_2 can be prepared by heating :
(1) NH_4NO_3 (2) $NaNO_3$ (3*) $Pb(NO_3)_2$ (4) KNO_3

B-7. Which of the following acids can form two types of salts?
(1*) Hyponitrous acid (2) Nitrous acid (3) Nitric acid (4) Pernitric acid

B-8. Concentrated nitric acid oxidises P into :
(1) PH_3 (2) P_2O_5 (3) HPO_3 (4*) H_3PO_4

B-9. Which of the following metals does not dissolve in concentrated HNO_3?
(1) Pb (2) Cu (3*) Au (4) Hg

B-10. $HNO_3 + P_4O_{10} \longrightarrow HPO_3 + X$
in the above reaction the product X is :
(1) NO_2 (2) N_2O_3 (3) N_2O_4 (4*) N_2O_5

B-11. Which one of the following allotropic forms of phosphorus does glow in dark ?
(1) Red (2) Black (3*) White (4) All of these

B-12. When P_4O_{10} is dissolved in water, the acid formed finally is :
(1) H_3PO_2 (2*) H_3PO_4 (3) H_3PO_3 (4) $H_4P_2O_7$

B-13. Metaphosphoric acid exists in polymeric form and may have :
(1) a linear structure (2) a cyclic structure
(3*) both linear as well as cyclic structures (4) none

B-14. Which of the following statements are correct ?
(a) NH_3 has higher boiling point than SbH_3 dues to H-bonding .
(b) NH_3 produces deep blue colouration with soluble copper (II) salts.
(c) Pure nitrogen can be obtained by the thermal decomposition of sodium or barium azide.
(d) N_2 is used for creating inert atmosphere in iron and steel industry.
(1) (b) and (c) only (2*) (b), (c) and (d) only
(3) (a), (b) and (c) only (4) All of these

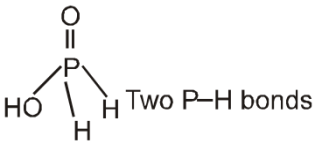
B-15. NH_4Cl (s) is heated in test tube. Vapours are brought in contact with red litmus paper, which changes to blue and then to red. It is because of :
(1) formation of NH_4OH and HCl (2) formation of NH_3 and HCl
(3*) greater diffusion of NH_3 than HCl (4) greater diffusion of HCl than NH_3

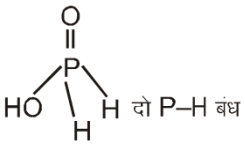
B-16. Which of the following statements are correct ?
(i) Red phosphorus is obtained by heating white phosphorus at 573 K in an inert atmosphere for several days.
(ii) α–black phosphorus is formed when red phosphorus is heated in a sealed tube at 803 K.
(iii) β–black phosphorus is obtained by heated white phosphorus at 473 K under high pressure.
(1) (i) and (ii) only (2) (ii) and (iii) only (3*) (i), (ii) and (iii) (4) (i) and (iii) only

B-17. The solution of phosphine in water decomposes in presence of light to give :
(1) white phosphorus only (2*) red phosphorus and H_2
(3) phosphorus pentaoxide and H_2 (4) phosphorus hydroxide.

B-18. Which of the following acids is monobasic?
(1*) H_3PO_2 (2) H_3PO_4 (3) $H_4P_2O_7$ (4) $H_4P_2O_6$.

B-19. Amongst the following acids, which one has strong reducing property ?
(1*) H_3PO_2 (2) H_3PO_4 (3) $(HPO_3)_3$ (4) $H_4P_2O_6$





Section (C) : Physical and Chemical properties of Group 16th elements :

C-1. Which of the following statements is false for group 16th elements ?
(1) Oxygen is a gas while other elements exist as solids.
(2) Sulphur exists as staggered 8-atom rings.
(3*) Density in solid stable decreases from oxygen to tellurium.
(4) First ionisation energy of sulphur is higher than that of selenium.

C-2. Which of the following acts as semi metal ?
(1) S (2*) Te (3) Po (4) O

C-3. Which element of chalcogens has maximum tendency to show catenation ?
(1) Oxygen (2) Selenium (3*) Sulphur (4) Tellurium

C-4. Which one of the following hydrides is the strongest acid ?
(1) H_2S (2) H_2Se (3*) H_2Te (4) H_2O

C-5. Which of the following compounds is the strongest reducing agent ?
(1) H_2O (2) H_2S (3) H_2Se (4*) H_2Te

C-6. If X is a member of chalcogen family, the highest stability of X^{2-} is exhibited by :
(1*) oxygen (2) selenium (3) tellurium (4) sulphur

C-7. Which of the following bonds has the highest energy ?
(1) Se—Se (2) Te—Te (3*) S—S (4) O—O

C-8. Which one of the following statements is false ?
(1) Because of the compact nature of oxygen atom, it has less negative electron gain enthalpy than sulphur.
(2) Next to fluorine, oxygen has the highest electronegativity value amongst the elements (exclude zero group).
(3) There is large difference in the melting and boiling points of oxygen and sulphur because oxygen exists as diatomic molecules (O_2) where as sulphur exists as polyatomic molecules (S_8) .
(4*) None

C-9. The correct order of the thermal stability of the following hydrides is :

H_2O	H_2Se	H_2S	H_2Te
(I)	(II)	(III)	(IV)

(1) I > II > III > IV (2*) I > III > II > IV (3) III > I > IV > II (4) IV > III > II > I

C-10. The boiling points of hydrides of group 16 are in the order :
(1) $H_2Te > H_2Se > H_2S > H_2O$ (2) $H_2O > H_2S > H_2Se > H_2Te$
(3*) $H_2O > H_2Te > H_2Se > H_2S$ (4) $H_2O > H_2Se > H_2S > H_2Te$

C-11. The increasing thermal stability of the hydrides of group 16 follows the sequence :
(1) H_2O, H_2S, H_2Se, H_2Te (2*) H_2Te, H_2Se, H_2S, H_2O
(3) H_2S, H_2O, H_2Se, H_2Te (4) H_2Se, H_2S, H_2O, H_2Te

C-12. Which of the following hydride is most acidic ?
(1*) H_2Te (2) H_2Se (3) H_2O (4) H_2S

C-13. The correct order of decreasing stability of hexa fluorides of group 16 members is :
(1*) $SF_6 > SeF_6 > TeF_6$ (2) $TeF_6 > SeF_6 > SF_6$ (3) $SF_6 > TeF_6 > SeF_6$ (4) $TeF_6 > SF_6 > SeF_6$

C-14. Which of the following allotropes of sulphur has maximum S^o at 0 K **[Made by SM Sir_2015]**
(1) Rhombic sulphur (2) Monoclinic sulphur (3*) Plastic sulphur (4) None of these

C-15. Correct statement about allotropy of sulphur is :
(SRA Sir) (PBC, N & O Family) (Allotropy of sulphur)
(1) Monoclinic sulphur is more stable than Rhombic sulphur at room temperature.
(2) Both Monoclinic and Rhombic sulphur have same ring structures and crystalline structure.
(3*) Rhombic sulphur exists at room temperature.
(4) None of these

C-16. Which of the following statement is false ?
(1) Superoxides give hydrogen peroxide and oxygen with water.
(2) CrO_3 is an acidic oxide.
(3) SnO_2 is an amphoteric oxide.
(4*) KO_2 is peroxide which with H_2O forms hydrogen peroxide only.

C-17. H_2S is far more volatile than water because :
(1) sulphur atom is more electronegative than oxygen atom.
(2*) oxygen being more electronegative than sulphur forms hydrogen bond.
(3) H_2O has bond angle of nearly 105°.
(4) hydrogen atom is loosely bonded with sulphur.

C-18. It is possible to obtain oxygen from air by fractional distillation because
(1) Oxygen is in a different group of the periodic table from nitrogen
(2) Oxygen is more reactive than nitrogen
(3*) Oxygen has higher b.p. than nitrogen
(4) Oxygen has a lower density than nitrogen

C-19. The most abundant element in the earth's crust is :
(1) aluminium (2*) oxygen (3) silicon (4) iron

Section (D) : Compounds of Oxygen and sulphur

D-1. $4HCl + O_2 \xrightarrow{(X)} 2Cl_2 + 2H_2O$
X is :

(1) $COCl_2$ (2*) $CuCl_2$ (3) V_2O_5 (4) FeO

D-2. Pure ozone is : (Select correct option)
(1) a pale blue gas (2) a dark blue liquid (3) a violet black (4*) all

D-3. Which of the following is responsible for the depletion of ozone layer ?
(1) Nitrogen oxide emitted from the exhaust systems of supersonic jet.
(2) Aerosol sprays
(3) Refrigerants
(4*) All of these

D-4. The compound which on strong heating gives oxygen is :
(1) $AgNO_3$ (2) BaO_2 (3) $Pb(NO_3)_2$ (4*) all of these

D-5. Ozone is obtained from oxygen :
(1) by oxidation at high temperature (2) by oxidation using a catalyst
(3*) by silent electric discharge (4) by conversion at high pressure

D-6. Ozone with KI solution produces :
(1) Cl_2 (2*) I_2 (3) HI (4) IO_3^-

D-7. A considerable part of the harmful UV rays of the sun does not reach the surface of the earth. This is because high above the earth's atmosphere , there is a layer of :

D-8. Which one of the following gives mixture of SO_2 and SO_3 on heating ?
(1) $ZnSO_4$ (2) $CuSO_4$ (3) $Fe_2(SO_4)_3$ (4*) $FeSO_4$

D-9. SO_2 can reduce :
(1) $HClO_3$ to HCl (2) $Cr_2O_7^{2-}$ / H^+ to Cr^{3+} (3) MnO_4^- / H^+ to Mn^{2+} (4*) all of these

D-10. The following catalyst is used in the manufacturing of sulphuric acid by lead chamber process.
(1*) NO (2) NO_2 (3) Pt (4) V_2O_5

D-11. Which of the following behaves as both oxidising and reducing agents ?
(1) H_2SO_4 (2*) SO_2 (3) H_2S (4) HNO_3

D-12. The acid which has a peroxy linkage is :
(1) sulphurous acid (2) pyrosulphuric acid (3) dithionic acid (4*) Caro's acid

D-13. Out of $H_2S_2O_3$, $H_2S_4O_6$, H_2SO_5 and $H_2S_2O_8$ peroxy acids are :
(1) $H_2S_2O_3$, $H_2S_4O_6$ (2) $H_2S_4O_6$, H_2SO_5 (3*) H_2SO_5 , $H_2S_2O_8$ (4) $H_2S_2O_3$, $H_2S_2O_8$

D-14. Which of the following statemetn is true about ozone layer ?
(1) It is harmful because ozone is dangerous to living organism.
(2) It is beneficial because oxidaiton reaction can proceed faster in the presence of ozone.
(3*) It is beneficial because ozone cuts out the ultraviolet radiation of the sun.
(4) It is beneficial because ozone cuts out the important radiation of the sun which are vital for photosynthesis.

D-15. Identify the incorrect statement with respect to ozone.
(1) Ozone is formed in the upper atmosphere by a photochemical reaction involving dioxygen.
(2) Ozone is more reactive than oxygen.
(3) Ozone is diamagnetic whereas disoxygen is paramagnetic.
(4*) Ozone protects the earth's inhabitants by absorbing γ radiations.

D-16. Which one of the following property is not correct for ozone.
(1) It oxidises lead sulphide. (2) It oxidises potassium iodide.
(3) It oxidises mercury. (4*) It cannot act as bleaching agent.

D-17. In the reaction $O_3 + I_2 + H_2O \longrightarrow (X) + O_2$. The compound (X) is :
(1*) HIO_3 (2) HI (3) HIO_4 (4) I_2O_5

Exercise-2

OBJECTIVE QUESTIONS(TOUGH LEVEL)

1. What are the covalence and oxidation state of nitrogen in N_2O_5 ?
(1) 5,5 (2*) 4,5 (3) 4,4 (4) None dksbZ ugha

2. Which statement is not correct for nitrogen ?
(1) It is obtained by heating $(NH_4)_2Cr_2O_7$ (2) It does not readily react with O_2
(3) It is a typical non-metal (4*) d-orbitals are available for bonding

3. A mixture of alumina and coke is heated in a current of nitrogen to about 1800ºC and the product obtained is treated with water. A gas is evolved. The gas is :

4. When ammonia is oxidsed by oxygen in the presence of platinum at 800ºC, the gas obtained is :
(1) N_2O (2*) NO (3) NO_2 (4) N_2O_5

5. Which of the following is a mixed acid anhydride ?
(1) NO (2*) NO_2 (3) N_2O_5 (4) N_2O

6. The boiling points of the following hydrides follow the order
(1*) $SbH_3 > NH_3 > AsH_3 > PH_3$ (2) $NH_3 > PH_3 > AsH_3 > SbH_3$
(3) $NH_3 > SbH_3 > AsH_3 > PH_3$ (4) $SbH_3 > AsH_3 > NH_3 > PH_3$

7. Which of the following statement is incorrect for phosphine ?
(1) It is not very soluble in water and aqueous solutions are neutral.
(2*) The solution of PH_3 in water is stable even in presence of sun light.
(3) It does react with gaseous HI to form PH_4I.
(4) The spontaneous combustion of phosphine is technically used in Holme's signals.

8. Holme's signals can be given by using
(1) $CaC_2 + CaCN_2$ (2*) $CaC_2 + Ca_3P_2$ (3) $CaC_2 + CaCO_3$ (4) $Ca_3P_2 + CaCN_2$

9. Column -I contains the different oxo-acids of phosphorus and Column- II contains their methods of preparation. Match the column-I with column-II and give the correct answer using the codes given.

Column I		Column II	
(a)	H_3PO_2	(p)	$P_4O_{10} + H_2O$
(b)	H_3PO_4	(q)	$P_2O_3 + H_2O$
(c)	$H_3 PO_3$	(r)	$H_3PO_3 + Br_2$, heat in a sealed tube .
(d)	$(HPO_3)_3$	(s)	White P_4 + Alkali

	(a)	(b)	(c)	(d)		(a)	(b)	(c)	(d)
(1)	(p)	(q)	(r)	(s)	(2)	(r)	(p)	(q)	(s)
(3)	(s)	(r)	(q)	(p)	(4*)	(s)	(p)	(q)	(r)

10. Which of the following is not correctly matched with respect to the oxidation state of phosphorus atoms?
(1) POF_3 ; +5 (2) NaH_2PO_2 ; + 1 (3) Hg_3P_2 ; – 3 (4*) $H_4P_2O_6$; + 5

11. Phosphorus trichloride, PCl_3 undergoes, hydrolysis at room temperature to produce an oxoacid. It has the formula :
(1) HPO_3 (2*) H_3PO_3 (3) H_3PO_4 (4) H_3PO_2

12. The true statement for the acids of phosphorus, H_3PO_2 , H_3PO_3 and H_3PO_4 is :
(1) H_3PO_3 on heating does not disproportionate
(2) H_3PO_2 and H_3PO_3 both have two P–OH bonds.
(3) all of them are tribasic acids
(4*) H_3PO_2 is obtained by alkaline hydrolysis of P_4 (white)

13. **Assertion :** Pure phosphine is non inflammable .
Reason : Impure phosphine is inflammable owing to the presence of P_2H_4 or P_4 vapours.
(1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2*) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

14. **Assertion :** $R_3P=O$ exists but $R_3N=O$ does not exist.
Reason : Nitrogen can not for $d\pi - p\pi$ bond as it does not have d – orbital and thus restricting its covalency to four .
(1*) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

Group 16th

15. Which among the following statements are correct ?
(a) Rhombic sulphur transforms to monoclinic sulphur when heated above 369 K.
(b) Solution of roll sulphur in CS_2 , on evaporation gives the crystals of rhombic sulphur.
(c) Both rhombic and monoclinic sulphur have S_8 molecules.
(d) Both rhombic and monoclinic sulphur are soluble in carbon disulphide.
(1) (a) and (b) only (2) (a), (b) and (c) only
(3) (b), (c) and (d) only (4*) (a), (b), (c) and (d)

16. Which of the following reactions represents the reducing behaviour of SO_2?

(1) $2NaOH\ (aq) + SO_2(g) \longrightarrow Na_2SO_3\ (aq) + H_2O\ (\ell)$

(2) $SO_2(g) + Cl_2(g) \xrightarrow{\text{charcoal}} \xrightarrow{\text{pkjdkg}} SO_2Cl_2(l)$

(3*) $2Fe^{3+} + SO_2\ (g) + 2H_2O \longrightarrow 2Fe^{2+} + SO_4^{2-} + 4H^+$

(4) $2H_2S + SO_2 \longrightarrow 2H_2O + 3S$

17. The thermal stability of hydrides of oxygen family is in order :

(1*) $H_2Po < H_2Te < H_2Se < H_2S < H_2O$ (2) $H_2Po < H_2O < H_2Te < H_2Se < H_2S$

(3) $H_2S < H_2O < H_2Te < H_2Se < H_2Po$ (4) $H_2O < H_2S < H_2Te < H_2Se < H_2Po$

18. The gas respectively absorbed by alkaline pyrogallol and oil of cinnamon is :

(1*) O_2, O_3 (2) SO_2, O_3 (3) O_3, CH_4 (4) N_2O, O_3

19. Consider the following compounds :

(i) sulphur dioxide (ii) hydrogen peroxide (iii) ozone

Among these compounds, those which can act as bleaching agents would include :

(1) 1 and 3 (2) 2 and 3 (3) 1 and 2 (4*) 1, 2 and 3

20. When an article is bleached by SO_2 it loses its colour. The colour can be restored by :

(1*) exposure to air (2) heating (3) dilution (4) none of these

21. A gas that can not be collected over water is :

(1) N_2 (2) O_3 (3*) SO_2 (4) PH_3

22. Which of the following statement is true for sulphur dioxide?

(1) It reacts with dry chlorine in absence of moisture to form sulphuryl chloride.

(2) It in acidic medium reduces halogens to corresponding halides.

(3) Burning magnesium and potassium continue to burn in its atmosphere.

(4*) All above are correct.

23. Which of the following does not have S–S linkage but have O—O linkage ?

(1*) $S_2O_8^{2-}$ (2) $S_2O_6^{2-}$ (3) $S_2O_5^{2-}$ (4) $S_2O_3^{2-}$

24. There is no S–S bond in :

(1) $S_2O_4^{2-}$ (2) $S_2O_5^{2-}$ (3) $S_2O_3^{2-}$ (4*) $S_2O_7^{2-}$

25. **Assertion :** In contact process of the manufacture of H_2SO_4, conversion of SO_2 to SO_3 by the reaction with oxygen, takes place in presence of a catalyst V_2O_5.

Reason : The reaction which involves the conversion of SO_2 to SO_3 is exothermic, reversible and the forward reaction leads to a decrease in volume.

(1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion

(2*) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion

(3) The assertion is incorrect, but the reason is correct

(4) Both are assertion and reason are incorrect

Exercise-3

PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

OFFLINE JEE-MAIN

1. Polyphosphates are used as water softening agents because they : **[AIEEE 2002, 3/225]**
(1) form soluble complexes with anionic species (2) precipitate anionic species
(3*) form soluble complexes with cationic species (4) precipitate cationic species

2. Select the correct statement for H_3PO_3 and H_3PO_2. **[AIEEE 2003, 3/225]**
(1) H_3PO_3 is tribasic and reducing (2) H_3PO_2 is dibasic and reducing
(3*) H_3PO_2 is monobasic and reducing (4) H_3PO_3 is dibasic and non-reducing

3. Amongst the following the acid having –O–O– bonds is : **[AIEEE 2004, 3/225]**
(1) $H_2S_2O_3$ (2) $H_2S_2O_5$ (3) $H_2S_2O_6$ (4*) $H_2S_2O_8$

4. Which is the most reactive allotropic form of phosphorus ? **[AIEEE 2005, 3/225]**
(1) Red (2*) White (2) Black (4) Brown

5. The number of hydrogen atom (s) attached to phosphorus atom in hypophosphorus acid is : **[AIEEE 2005, 3/225]**
(1) zero (2*) two (3) one (4) three

6. Which of the following chemical reactions depicts the oxidizing behaviour of H_2SO_4? **[AIEEE 2006, 3/165]**
(1*) $2HI + H_2SO_4 \rightarrow I_2 + SO_2 + 2H_2O$ (2) $Ca(OH)_2 + H_2SO_4 \rightarrow CaSO_4 + 2H_2O$
(3) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$ (4) $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$

7. Regular use of which of the following fertilizers increases the acidity of soil? **[AIEEE 2007, 3/120]**
(1) Superphosphate of lime (2*) Ammonium sulphate
(3) Potassium nitrate (4) Urea
$(NH_4)_2SO_4$ on hydrolysis produces strong acid H_2SO_4, which increases the acidity of the soil.

8.* Which of the following statement is wrong? **[AIEEE 2011, 4/120]**
(1*) The stability of hydrides increase from NH_3 to BiH_3 in group 15 of the periodic table :
(2) Nitrogen cannot form $d\pi$-$p\pi$ bond.
(3) Single N – N bond is weaker than the single P – P bond.
(4*) N_2O_4 has two resonance structure

9. Which of the following statements regarding sulphur is **incorrect** ? **[AIEEE 2011, 4/120]**
(1) S_2 molecule is paramagnetic.
(2) The vapour at 200ºC consists mostly of S_8 rings.
(3) At 600ºC the gas mainly consists of S_2 molecules.
(4*) The oxidation state of sulphur is never less than +4 in its compounds.
Sol. Sulphur exhibit + 2, + 4, + 6 oxidation states but + 4 and + 6 are more common.

10. Which of the following is the wrong statement ? **[JEE(Main) 2013, 4/120]**

(1) ONCl and ONO^- are not isoelectronic. (2) O_3 molecule is bent
(3) Ozone is violet-black in solid state (4) Ozone is diamagnetic gas.

11. Which of the following properties is not shown by NO ? **[JEE(Main) 2014, 4/120]**
(1*) It is dimagnetic in gaseous state
(2) It is a neutral oxide
(3) It combines with oxygen to form nitrogen dioxide
(4) It's bond order is 2.5

12. From the following statements regarding H_2O_2, choose the **incorrect** statement : **[JEE(Main) 2015, 4/120]**
(1*) It can act only as an oxidizing agent
(2) It decomposed on exposure to light
(3) It has to be stored in plastic or wax lined glass bottles in dark
(4) It has to be kept away from dust

13. **Assertion :** Nitrogen and Oxygen are the main components in the atmosphere but these do not react to form oxides of nitrogen. **[JEE(Main) 2015, 4/120]**
Reason : The reaction between nitrogen and oxygen requires high temperature.
(1*) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

14. The pair in which phosphorous atoms have a formal oxidation state of +3 is: **[JEE(Main) 2016, 4/120]**
(1) Pyrophosphorous and hypophosphoric acids
(2) Orthophosphorous and hypophosphoric acids
(3) Pyrophosphorous and pyrophosphoric acids
(4*) Orthophosphorous and pyrophosphorous acids

15. The reaction of zinc with dilute and concentrated nitric acid, respectively, produces: **[JEE(Main) 2016, 4/120]**
(1) NO_2 and NO (2) NO and N_2O (3) NO_2 and N_2O (4*) N_2O and NO_2

ONLINE JEE-MAIN

1. The gas evolved on heating CaF_2 and SiO_2 with concentrated H_2SO_4, on hydrolysis gives a white gelatinous precipitate. The precipitate is : **[JEE(Main) 2014 Online (09-04-14), 4/120]**
(1) hydrofluosilicic acid (2) silica gel
(3*) silicic acid (4) calciumfluorosilicate

2. Which of the following statements about the depletion of ozone layer is correct ? **[JEE(Main) 2014 Online (11-04-14), 4/120]**
(1) The problem of ozone depletion is less serious at poles because NO_2 solidifies and is not available for consuming $ClO^{\bullet}$ radicals.
(2*) The problem of ozone depletion is more serious at poles because ice crystals in the clouds over poles act as catalyst for photochemical reactions involing the decomposition of ozone by $Cl^{\bullet}$ and $Cl^{\bullet}$ radicals.
(3) Freons, chlorofluorocarbons, are inert chemically, they do not react with ozone in stratosphere.

(4) Oxides of nitrogen also do not react with ozone in stratosphere.

3. Consider the reaction :

$$H_2SO_{3(aq.)} + Sn^{4+}_{(aq)} + H_2O_{(l)} \rightarrow Sn^{2+}_{(aq)} + HsO^{-}_{4(aq)} + 3H^{+}_{(aq)}$$

Which of the following statements is correct ? **[JEE(Main) 2014 Online (19-04-14), 4/120]**

(1) Sn^{4+} is the oxidizing agent because it undergoes oxidation
(2) Sn^{4+} is the reducing agent because it undergoes oxidation
(3*) H_2SO_3 is the reducing agent because it undergoes oxidation
(4) H_2SO_3 is the reducing agent because it undergoes reduction

4. Which of these statements is not true ? **[JEE(Main) 2014 Online (19-04-14), 4/120]**

(1*) NO^+ is not isoelectronic with O_2
(2) B is always covalent in its compounds
(3) In aqueous solution, the Tl^+ ion is much more stable than Tl(III)
(4) $LiAlH_4$ is a versatile reducing agent in organic synthesis.

5. Identify the incorrect statement: **[JEE(Main) 2016 Online (10-04-16), 4/120]**

(1) Rhombic and monoclinic sulphur have S_8 molecules.
(2) S_8 ring has a crown shape.
(3) S_2 is paramagnetic like oxygen.
(4*) The S–S–S bond angles in the S_8 and S_6 rings are the same.

6. In which of the following reactions, hydrogen peroxide acts as an oxidizing agent ? **[JEE(Main) 2017 Online (08-04-17), 4/120]**

(1*) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$ (2) $2MnO_4^- + 3H_2O_2 \rightarrow 2MnO_2 + 3O_2 + 2H_2O + 2OH^-$
(3) $I_2 + H_2O_2 + 2OH^- \rightarrow 2I^- + 2H_2O_2 + O_2$ (4) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$

PART - II : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

*** Marked Questions may have more than one correct option.**

Section (A) : Group 15th

1. The number of P—O—P bonds in cyclic trimetaphosphoric acid is : **[JEE 2000,(S) 3/35]**

(A) zero (B) two (C*) three (D) four

2. The correct order of acidic strength is : **[JEE 2000,(S) 3/35]**

(A*) $Cl_2O_7 > SO_2 > P_4O_{10}$ (B) $CO_2 > N_2O_5 > SO_3$
(C) $Na_2O > MgO > Al_2O_3$ (D) $K_2O > CaO > MgO$

3. Ammonia can be dried by : **[JEE 2000,(S) 3/35]**

(A) conc. H_2SO_4 (B) P_4O_{10} (C*) CaO (D) anhydrous $CaCl_2$

4. Polyphosphates are used as water softening agents because they : **[JEE 2002(S), 3/90]**

(A) form soluble complexes with anionic species
(B) precipitate anionic species
(C*) form soluble complexes with cationic species
(D) precipitate cationic species

5. For H_3PO_3 and H_3PO_4 , the correct choice is : **[JEE 2003 (S), 3/84]**
(A*) H_3PO_3 is dibasic and reducing (B) H_3PO_3 is dibasic and non-reducing
(C) H_3PO_4 is tribasic and reducing (D) H_3PO_3 is tribasic and non-reducing

6. $(NH_4)_2 Cr_2O_7$ on heating gives a gas which is also given by : **[JEE 2004 (S), 3/84]**
(A*) heating NH_4NO_2 (B) heating NH_4NO_3
(C) treating $Mg_3 N_2$ with H_2O (D) treating Na(compound) with H_2O_2

7. A pale blue liquid is obtained by equimolar mixture of two gases at –30ºC. **[JEE 2005 (S), 3/84]**
(A) N_2O (B*) N_2O_3 (C) N_2O_4 (D) N_2O_5

8. Thermodynamically most stable allotrope of phosphorus is : **[JEE 2005 (S), 3/84]**
(A) Red (B) White (C*) Black (D) Yellow

Paragraph for Question Nos. 9 to 11

There are some deposits of nitrates and phosphates in earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under the laboratory conditions but microbes do it easily. Ammonia forms large number of complexes with transition metal ions. Hybridization easily explains the ease of sigma donation capability of NH_3 and PH_3. Phosphine is a flammable gas and is prepared from white phosphorous.

9. Among the following, the correct statement is : **[JEE 2008, 4/163]**
(A) phosphates have no biological significance in humans.
(B) between nitrates and phosphates, phosphates are less a abundant in earth's crust.
(C*) between nitrates and phosphates, nitrates are less abundant in earth's crust.
(D) oxidation of nitrates is possible in soil.

10. Among the following, the correct statement is : **[JEE 2008, 4/163]**
(A) between NH_3 and PH_3, NH_3 is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional.
(B) between NH_3 and PH_3, PH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional.
(C*) between NH_3 and PH_3, NH_3 is a better electron donor because the lone pair of electrons occupies sp^3 orbital and is more directional.
(D) between NH_3 and PH_3, PH_3 is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional.

11. White phosphorus on reaction with NaOH gives PH_3 as one of the products. This is a : **[JEE 2008, 4/163]**
(A) dimerization reaction (B*) disproportionation reaction
(C) condensation reaction (D) precipitation reaction

12. The reaction of P_4 with **X** leads selectively to P_4O_6. The **X** is : **[JEE 2009, 3/160]**
(A) Dry O_2 (B*) A mixture of O_2 and N_2
(C) Moist O_2 (D) O_2 in the presence of aqueous NaOH

13. Match each of the reactions given in **column I** with the corresponding products (s) given in **column II.** **[JEE 2009, 8/160]**

	Column I		**Column II**
(A)	Cu + dil HNO_3	(p)	NO
(B)	Cu + conc HNO_3	(q)	NO_2
(C)	Zn + dil HNO_3	(r)	N_2O
(D)	Zn + conc HNO_3	(s)	$Cu(NO_3)_2$
		(t)	$Zn(NO_3)_2$

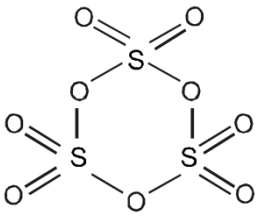
14. Extra pure N_2 can be obtained by heating **[JEE 2011 (Pt-1) 3/160]**
(A) NH_3 with CuO (B) NH_4NO_3
(C) $(NH_4)_2Cr_2O_7$ (D*) $Ba(N_3)_2$

15. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen? **[JEE 2012 (P-I), 3/136]**
(A) HNO_3, NO, NH_4Cl, N_2 (B*) HNO_3, NO, N_2, NH_4Cl
(C) HNO_3, NH_4Cl, NO, N_2 (D) NO, HNO_3, NH_4Cl, N_2

Section (B) : Group 16th

16. Amongst H_2O, H_2S, H_2Se and H_2Te the one with highest boiling point is :**[JEE 2000 (S), 3/35]**
(A*) H_2O because of H-bonding. (B) H_2Te because of higher molecular weight.
(C) H_2S because of H-bonding. (D) H_2Se because of lower molecular weight.

17. The number of S–S bonds, in sulphur trioxide trimer (S_3O_9) is : **[JEE 2001 (S), 3/35]**
(A) three (B) two (C) one (D*) Zero

Sol.  There is no S-S bond in S_3O_9 .

18. Which of the following oxoacids of sulphur has –O–O– linkage ? **[JEE 2004 (S), 3/84]**
(A) $H_2S_2O_3$ (B) $H_2S_2O_5$ (C) $H_2S_2O_6$ (D*) $H_2S_2O_8$

19. Which of the following is not oxidised by O_3 ? **[JEE 2005 (S), 3/84]**
(A) KI (B*) $KMnO_4$ (C) K_2MnO_4 (D) $FeSO_4$

20. Which gas is evolved when PbO_2 is treated with concentrated HNO_3 \ **[JEE 2005 (S), 3/84]**
(A) NO_2 (B*) O_2 (C) N_2 (D) N_2O

21. Aqueous solution of $Na_2S_2O_3$ on reaction with Cl_2 gives : **[JEE 2008 (P-I), 3/82]**
(A) $Na_2S_4O_6$ (B*) $NaHSO_4$ (C) NaCl (D) NaOH

23. Hydrogen peroxide in its reaction with KIO_4 and NH_2OH respectively, is acting as a
(A*) reducing agent, oxidising agent **[JEE(Advanced) 2014 (P-II), 3/120]**
(B) reducing agent, reducing agent

(C) oxidising agent, oxidising agent
(D) oxidising agent, reducing agent

24. The product formed in the reaction of $SOCl_2$ with white phosphorous is : **[JEE(Advanced) 2014 (P-II), 3/120]**

(A*) PCl_3 (B) SO_2Cl_2 (C) SCl_2 (D) $POCl_3$

PARAGRAPH-1

Upon heating $KClO_3$ in the presence of catalytic amount of MnO_2, a gas **W** is formed. Excess amount of **W** reacts with white phosphorus to give **X**. The reaction of **X** with pure HNO_3 gives **Y** and **Z**.

25. **Y** and **Z** are, respectively **[JEE(Advanced) 2017, 3/122]**

(A) N_2O_4 and HPO_3 (B) N_2O_4 and H_3PO_3 (C) N_2O_3 and H_3PO_4 (D*) N_2O_5 and HPO_3

26. **W** and **X** are, respectively **[JEE(Advanced) 2017, 3/122]**

(A*) O_2 and P_4O_{10} (B) O_2 and P_4O_6 (C) O_3 and P_4O_6 (D) O_3 and P_4O_{10}

Additional Problems For Self Practice (APSP)

PART - I : PRACTICE TEST PAPER

This Section is not meant for classroom discussion. It is being given to promote self-study and self testing amongst the Resonance students.

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions

1. The test is of **1 hour** duration.

2. The Test Booklet consists of **30** questions. The maximum marks are **120.**

3. Each question is allotted **4 (four)** marks for correct response.

4. Candidates will be awarded marks as stated above in Instructions No.3 for correct response of each question.
¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.

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1. There is considerable increase in covalent radius from N to P. However, from Sb to Bi only small increase (of 7 pm) in covalent radius is observed. This is due to :
(1*) poor shielding by completely filled d- and f-orbitals in Bi.
(2) similar eletronegativity of Sb and Bi.
(3) the Bi being last element of the group.
(4) similar densities of Sb and Bi.

2. Of the different allotropes of phosphorus, the one which is most reactive is
(1) Violet phosphorus (2) Scarlet phosphorus (3) Red phosphorus (4*) White phosphorus

3. Which of the following elements shows highest number of allotropes : **[Made by SM Sir_2015]**
(1) N (2) P (3*) S (4) O

4. Nitrogen gas is prepared :
(1) by heating ammonium nitrate.
(2) by reacting excess chlorine with liquor ammonia.
(3*) by passing HNO_3 vapours on red hot copper.
(4) by heating lead nitrate.

5. With respect to protonic acids, which of the following statement is correct ?
(1) PH_3 is more basic than NH_3 (2*) PH_3 is less basic than NH_3
(3) PH_3 is equally basic as NH_3 (4) PH_3 is amphoteric while NH_3 is basic.

6. Phosphorus is manufactured by heating in an electric furnance a mixture of
(1) Bone ash and coke (2) Bone ash and silica
(3*) Bone ash, silica and coke (4) None of these

7. Which of the following may ignite spontaneously in air ?
(1*) White phosphorus (2) Red phosphorus

(3) Black phosphorus (4) Nitrogen

8. Ozone is obtained from oxygen
(1) By oxidation at high temperature (2) By oxidation using a catalyst
(3*) By silent electric discharge (4) By conversion at high pressure

9. Crown shape of S_8 molecule is present in :
(1) Rhombic sulphur (2) Monoclinic sulphur (3*) Both (1) & (2) (4) None of these

10. Presence of ozone in a gas sample may be detected by : **[Made by SM Sir_2015]**
(1) H_2O_2 (2) SO_2 (3*) Hg (4) KI

11. Amongst H_2O, H_2S, H_2Se and H_2Te the one with the highest boiling point is
(1*) H_2O because of hydrogen bonding (2) H_2Te because of higher molecular weight
(3) H_2S because of hydrogen bonding (4) H_2Se because of lower molecular weight

12. When ammonia is passed over heated copper oxide, the metallic copper is obtained. The reaction shows that ammonia is
(1) A dehydrating agent (2) An oxidising agent
(3*) A reducing agent (4) A nitrating agent

13. Phosphine is generally prepared in the laboratory
(1) By heating phosphorus in a current of hydrogen
(2*) By heating white phosphorus with aqueous solution of caustic potash
(3) By decomposition of P_2H_4 at 110ºC
(4) By heating red phosphorus with an aqueous solution of caustic soda.

14. Cyanamide process is used in the formation of
(1) N_2 (2) HNO_3 (3*) NH_3 (4) PH_3

15. Ammonium nitrate decomposes on warming into
(1) Ammonia and nitric acid (2*) Nitrous oxide and water
(3) Nitrogen, hydrogen and ozone (4) Nitric oxide, nitrogen dioxide and hydrogen

16. Which one of the following combines with Fe(II) ions to form a brown complex?
(1) N_2O (2*) NO (3) CO (4) SO_2

17. Formula for tear gas is : **[AFMC 2005]**
(1) $COCl_2$ (2*) CCl_3NO_2 (3) N_2O (4) None of these

18. In P_4O_{10}, the number of oxygen atoms bonded to each phosphorus atom are :
(1) 2 (2) 3 (3*) 4 (4) 5

19. In the reaction, conc. $H_2SO_4 + P_2O_5 \xrightarrow{\Delta} (X) + SO_3$; the major product (X) is :
(1) PH_3 (2) H_3PO_4 (3*) HPO_3 (4) $H_4P_2O_7$

20. Bleaching action of SO_2 is due to :
(1*) its reducing nature (2) its oxidising nature
(3) its acidic nature (4) its both oxidising as well as reducing nature

21. Ortho phosphoric acid on heating above 300ºC gives :
(1) hypophosphorus acid (2) hypophosphoric acid
(3*) metaphosphoric acid (4) phosphorous acid

22. 1 mol each of H_3PO_2, H_3PO_3 and H_3PO_4 will neutralise x mole of NaOH, y mol of $Ca(OH)_2$ and z mol of $Al(OH)_3$ (assuming all as strong electrolytes) respectively. x, y, z are in the ratio of :

23. Which of the following can convert acidified $Cr_2O_{7}^{2-}$ to green ?
(1) SO_2 / H_2SO_3 / H_2SO_4 (2) SO_3 / H_2SO_3 / H_2S
(3*) SO_3^{2-} / H_2S / Fe^{2+} (4) $S_2O_3^{2-}$ / SO_3 / Fe^{3+}

24. Which of the following statements is true for HNO_2 ?
(1) It can be prepared by acidifying an aqueous solution of nitrite.
(2) It is unstable weak acid which is known only in aqueous solution.
(3) N_2O_3 is an anhydride of HNO_2.
(4*) All of these

25. The compound which has ionic nature in solid state is :
(1*) PCl_5 (2) $POCl_3$ (3) P_4O_{10} (4) PCl_3

26. Phosphorus trichloride, PCl_3 undergoes, hydrolysis at room temperature to produce an oxoacid. It has the formula :
(1) HPO_3 (2*) H_3PO_3 (3) H_3PO_4 (4) H_3PO_2

27. Which of the following dissolves in water but does not give any oxyacid solution? **[RPMT–2008]**
(1) SO_2 (2*) OF_2 (3) SCl_4 (4) SO_3

28. Hypo is used in photography to:
(1) Reduce AgBr grains to metallic silver
(2) Convert the metallic silver to silver salt
(3*) Remove undecomposed silver bromide as a soluble complex
(4) Remove reduced silver

29. Sulphur on boiling with NaOH solution gives
(1) $Na_2S_2O_3$ + $NaHSO_3$ (2*) $Na_2S_2O_3$ + Na_2S
(3) Na_2SO_3 + H_2S (4) Na_2SO_3 + SO_2

30. Sodium thiosulphate is prepared by **[JEE 1996, 1]**
(1) reducing Na_2SO_3 solution with H_2S (2*) Boiling Na_2SO_3 with S in alkaline medium.
(3) Neutralising $H_2S_2O_3$ solution with NaOH (4) Boiling Na_2SO_3 with S in an acidic medium

Practice Test Paper (JEE-Main Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

PART - II : PRACTICE QUESTIONS

1. Heating of Ag with conc. HNO_3 gives
(1) NO (2*) NO_2 (3) N_2O (4) N_2O_3

2. Which of the following is incorrect for the oxides of 16th group elements ?
(1) Reducing property of their dioxides decreases from SO_2 to TeO_2
(2) Basic character of their dioxide increases down the group i.e acidic character decreases down the group.
(3) (1) and (4) both
(4*) None

3. H_2S cannot be dried by :
(1) anhydrous $CaCl_2$ (2) P_2O_5 (3*) Conc. H_2SO_4 (4) All of these

4. Hot concentrated sulphuric acid dissolves sulphur forming :
(1) SO_3 (2*) SO_2 (3) H_2SO_3 (4) $H_2S_2O_3$

5. $NH_4ClO_4 + HNO_3(\text{dilute}) \longrightarrow HClO_4 + [X]$
$[X] \xrightarrow{\Delta} Y(g)$
[X] and [Y] are respectively.
(1*) NH_4NO_3 and N_2O (2) NH_4NO_2 and N_2 (3) HNO_4 and O_2 (4) None

6. Which oxide of N is neutral ?
(1) N_2O_3 (2) N_2O_5 (3) N_2O_4 (4*) N_2O

7. The decrease stability of higher oxidation state in p–block with increasing atomic number is due to:
(1) decrease in bond energy as going down the group.
(2) energy required to unpair ns^2 – electrons is not compensated by the energy released in forming the two additional bonds.
(3*) both are correct.
(4) none is correct.

8. Ammonia can be dried by :
(1) conc. H_2SO_4 (2) P_4O_{10} (3) anhydrous $CaCl_2$ (4*) none

9. For H_3PO_3 and H_3PO_4, the correct choice is:
(1) H_3PO_3 is stronger acid than H_3PO_4 (2) H_3PO_3 is dibasic and reducing.
(3) H_3PO_4 is tribasic and reducing (4*) (A) and (B) both

10. Which of the following statement is correct ?
(1) Black phosphorus is thermodynamically most stable allotrope of phosphorus:
(2) One mole of calcium phosphide on reaction with excess water gives two moles of phosphine
(3) PbO_2 on treatment with concentrated HNO_3 produces NO_2 gas.
(4*) (A) and (B) both

11. $H_2SO_4 + NaCl\ (s) \longrightarrow NaHSO_4 + HCl$. Hydrochloric acid is liberated because
(1) H_2SO_4 is a reducing agent. (2) HCl is a smaller molecule than H_2SO_4
(3*) HCl is more volatile than H_2SO_4 (4) (2) and (3) Both

12. In the following reaction, $2MnO_4^- + 5H_2O_2^{18} + 6H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5O_2$
The radioactive oxygen will appear in :
(1) H_2O (2*) O_2
(3) both H_2O & O_2 (4) above reaction does not take place

13. Which of the following statement is false for sulphurdioxide ?
(1) It reacts with dry chlorine in presence of charcoal to form sulphuryl chloride.
(2) It reduces KIO_3 to iodine in acidic medium.
(3*) It when passed through a solution of sodium sulphide, produces Na_2SO_3.
(4) It oxidises $SnCl_2$ to $SnCl_4$ in presence of HCl.

14. Which one of the following reactions will give oxygen gas ?
(1) A reaction of PbO_2 with concentrated HNO_3. (2) A reaction of MnO_2 with concentrated H_2SO_4.
(3) A reaction of $KMnO_4$ with concentrated HCl. (4*) (1) and (2) both

15. When a mixture of potassium chromate acidified with dilute sulphuric acid is shaken with ether after adding 'x', etheral layer first becomes deep blue and the colour rapidly changes to green. 'x' could be

16. Ozone reacts with $K_4Fe(CN)_6$ to form:
(1) Fe_2O_3 (2) $Fe(OH)_3$ (3) $Fe(OH)_2$ (4*) $K_3Fe(CN)_6$

17. Ozone turns benzidine paper :
(1) violet (2*) brown (3) blue (4) red

18. Selenium is used in :
(1) nuclear reactors (2*) xerox–type photocopiers
(3) mountaineering ropes (4) making artificial lungs

19. Red phosphorus can be prepared from white phosphorus by :
(1) adding red colour to white phosphorus
(2) heating white phosphorus to red heat
(3*) heating white phosphorus at high pressure, inert atmosphere to 250ºC or at low temperature in the presence of sun light.
(4) heating white phosphorus at low pressure to 250ºC or at low temperature in the presence of sun light.

20. Which of the following is the most basic oxide ?
(1) SeO_2 (2) P_2O_3 (3) Sb_2O_3 (4*) Bi_2O_3

21. $\underset{\text{Ammonium}}{NH_4^+}$, $\underset{\text{Ammonia}}{NH_3}$, $\underset{\text{Amide}}{NH_2^-}$, $\underset{\text{Imide}}{NH^{2-}}$ and $\underset{\text{Nitride}}{N^{3-}}$ are :
(1*) Isoelectronic (2) Isostructural
(3) Homologous members (4) Nitrogen has different oxidation state

22. Amongst the following oxo-acids of phosphorus , how many of them are dibasic in nature ?
H_3PO_2 , H_3PO_3, H_3PO_4, $H_4P_2O_5$
(1) 1 (2*) 2 (3) 3 (4) 4

23. The correct order of sulphur-oxygen bond order in $S_2O_3^{2-}$, SO_4^{2-}, SO_3 and $S_2O_6^{2-}$ is
(1) $S_2O_3^{2-} < SO_4^{2-} < SO_3 < S_2O_6^{2-}$ (2) $S_2O_3^{2-} < S_2O_6^{2-} < SO_4^{2-} < SO_3$
(3*) $S_2O_3^{2-} < SO_4^{2-} < S_2O_6^{2-} < SO_3$ (4) $S_2O_6^{2-} < SO_4^{2-} < SO_3 < S_2O_3^{2-}$

24. Ammonium salts decompose quite readily on heating :

(i) Ammonium salt of weak oxidizing anion (e.g. Cl^-, CO_3^{2-}, SO_4^{2-}) $\xrightarrow{heat}$ Gas X

(ii) Ammonium salt of strong oxidizing anion (e.g. NO_2^-, NO_3^-, ClO_4^-, $Cr_2O_7^{2-}$) $\xrightarrow{heat}$ Gas Y/Z

Identify X, Y, Z.

(1) N_2, NH_3, N_2O (2*) NH_3, N_2, N_2O (3) N_2O, NH_3, N_2 (4) NO, NH_3, N_2O

25. Which of the following is oxidised by O_3 ?

(1*) K_2MnO_4 (2) $Fe_2(SO_4)_3$ (3) $KMnO_4$ (4) $K_2Cr_2O_7$

26. About H_2SO_4 which is incorrect ?

(1*) Reducing agent (2) Dehydrating agent

(3) Sulphonating agent (4) Highly viscous

27. Which of the following reactions depict the oxidising behaviour of H_2SO_4 ?

(1) $2PCl_5 + H_2SO_4 \longrightarrow 2POCl_3 + 2HCl + SO_2Cl_2$ (2) $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

(3) $NaCl + H_2SO_4 \longrightarrow NaHSO_4 + HCl$ (4*) $2HI + H_2SO_4 \longrightarrow I_2 + SO_2 + 2H_2O$

28. Which of the following statements is false for the various allotropic forms of phosphorus ?

(1) White phosphorus readily catches fire in air but α-black phosphorus does not oxidise in air.

(2) α-black phosphorus can be sublimed in air and has opaque monoclinic or rhombohedral cystals.

(3*) Red phosphorus is insoluble in water but soluble in carbon disulphide.

(4) Amongst all allotropic forms, black phosphorus is thermodynamically most stable and white phosphorus is least stable.

29. Which of the following products is formed when phosphine is absorbed in copper sulphate solution?

(1) $Cu(OH)_2$ (2) $[Cu(PH_3)_4]SO_4$ (3*) Cu_3P_2 (4) $Cu_3(PO_4)_2$