# **Exercise-1**

Marked Questions may have for Revision Questions.

### **OBJECTIVE QUESTIONS**

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

A-2. Sol. Melting point ∝heat of atomization ∝ strength of metallic bond
 Strength of metallic bond depends on number of mobile electrons per atom and size of atom.

**A-3.** Sol. 
$$H_3 \stackrel{3+}{P}O_3 \longrightarrow H_3 \stackrel{5+}{P}O_4 + \stackrel{3-}{P}H_3$$

A-4. Sol. Has one lone pair of electrons on central atom which they can donate to lewis acid and the order of basicity is :

 $NH_3 > PH_3 > AsH_3 > SbH_3$ 

- **A-5.** Sol. Nitrogen exhibits oxidation states in the range 3 to + 5.
- A-6. Sol. (2) Statement is correct .
- **A-7. Sol.** The basic strength of the hydrides of group 15 elements down the group decreases with decrease in the electronegativity of the central atom according to Drago's rule.
- A-9. Sol. From top to bottom in group 15, reducing character of hydrides increases due to decrease in thermal stability.
- A-10. Sol. In nitrogen family all the elements show +5 oxidation state.
- **A-11.** Sol. Oxidation state of molecular sulphur S<sub>8</sub> is zero Oxidation state of sulphur in S<sub>2</sub>F<sub>2</sub> = 2x + 2(-1) = 0; 2x = +2 or x = 1Oxidation state of sulphur in H<sub>2</sub>S = 2(+1) + x = 0 or x = -2.
- A-12. Sol. Allotropes differ in their crystal structures and physical properties but have same chemical properties.
- A-13. Sol. Black phosphorus is thermodynamically most stable form of phosphorus as it is a highly polymerised form of phosphorus. Hence it is least reactive.
- **A-14. Sol.** The difference of electronegativities between nitrogen (V) and oxygen is least as compared to that of in the other oxides. On moving down the group acidic strength decreses.
- A-15. Sol. Sb<sub>4</sub>O<sub>6</sub> reacts with NaOH forming arsenite as well as HCl forming SbCl<sub>3</sub>.



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Sol.

A-17.

Section (B) : Compounds of Nitrogen and phosphorus							
B-1.	Sol.	$(NH_4)_2 \operatorname{Cr}_2 \operatorname{O}_7 \xrightarrow{\Delta} N_2 + 4 \operatorname{H}_2 O + \operatorname{Cr}_2 O_3$					
B-3.	Sol.	$NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O.$					
B-4.	Sol: Cu and	$4Zn + 10HNO_3 \longrightarrow 4Zn (NO_3)_2 + 5H_2O + N_2O$ Pb give NO with dilute HNO <sub>3</sub> and Au is not attached by dilute HNO <sub>3</sub> .					
B-5.	Sol.	$Fe^{2+} + 5H_2O + NO \longrightarrow [Fe(H_2O)_5NO]^{2+}$					
B-6.	<b>Sol.</b> NaNO₃	2Pb $(NO_3)_2 \xrightarrow{673K}$ 2PbO + 4NO <sub>2</sub> + O <sub>2</sub> and KNO <sub>3</sub> gives their nitrites and O <sub>2</sub> where as NH <sub>4</sub> NO <sub>3</sub> gives N <sub>2</sub> O.					
B-7.	Sol.	$H_2N_2O_2$ (two replaceable hydrogen) and thus form two series of salts.					
B-8.	Sol.	$P_4$ + 20HNO <sub>3</sub> (concentrated) ¼lkanz½ $\longrightarrow$ 4H <sub>3</sub> PO <sub>4</sub> + 20NO <sub>2</sub> + 4H <sub>2</sub> O.					
B-9.	Sol.	Gold dissolves only in aquaregia.					
B-10.	Sol.	$4HNO_3 + P_4O_{10} \xrightarrow{250K} 4HPO_3 + N_2O_5 \text{ (anhydride of HNO_3)}$					
B-11.	Sol.	White phosphorus glows in dark and the phenomenone is known as chemiluminescnce.					
B-12.	Sol.	$P_4O_{10} + 6H_2O \longrightarrow 4H_3PO_4$					
B-13. B-14.	<b>Sol.</b> Sol :	$\begin{array}{c} O \\ O \\ HO \\ HO \\ HO \\ HO \\ HO \\ HO \\ $					
B-15.	Sol.	Order of the rate of diffusion $NH_3 > HCI$ .					
B-16.	Sol.	All statements are correct.					
		0 					

B-18. Sol.

It has one replaceable hydrogen.

Ĥ.

Ή

HO





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

- C-1. Sol. (3) Increases from O to Te with increasing atomic number.
- C-2. Sol. S and O-non-metals ; Po-metal ; Te and Se semi-metals.
- **C-9.** Sol. Bond dissociation enthalpy decreases down the group with increasing H–E bond length with increasing size of atoms from O to Te.
- C-15. Sol. Stability (Mono clinic < Rhombic) Monoclinic and Rhombic sulphur have same puckered ring structure but they differs in crystalline structure.
- **C-16.** Sol.  $KO_2$  exists as  $K^+$  and  $O_2^-$ ; so it is superoxide.

 $2KO_2 + 2H_2O \longrightarrow 2KOH + H_2O_2 + O_2$ 

- **C-17.** Sol. As water has H-bonding due to the presence of highly electronegative oxygen but H<sub>2</sub>S does not (electronegativity of sulphur is low).
- C-18. Sol. Factual
- C-19. Sol. Most abundant element is earth crust is oxygen

#### Section (D) : Compounds of Oxygen and sulphur

- **D-4.** Sol.  $AgNO_3 \xrightarrow{\Delta} Ag + NO_2 + \frac{1}{2}O_2$ ;  $2BaO_2 \xrightarrow{800^\circ C} 2BaO + O_2$ .  $Pb(NO_3)_2 \xrightarrow{\Delta} PbO + 2NO_2 + \frac{1}{2}O_2$
- D-7. Sol. There is ozone layer high above the earth atmosphere which prevents the UV rays of the sun reaching the earth surface. i`Foh ds Åij ok;qe.My esa ,d ijr gksrh gS] tks lw;Z ds izdk'k dh UV fdj.kksa dk gkfudkjd Hkkx i`Foh rd iggi pus ls iksdrh gSA
- **D-8.** Sol.  $2Fe_2(SO_4)_3 \xrightarrow{\Delta} Fe_2O_3 + SO_2 + SO_3$
- **D-9.** Sol. SO<sub>2</sub> acts as reducing agent only in presence of strong oxidising agent.
- **D-10.** Sol. Lead chamber process,  $2SO_2 + O_2$  (air) +  $2H_2O + NO$  (catalyst)  $\longrightarrow 2H_2SO_4 + NO$ .



**D-15.** Sol. By absorbing UV radiations not  $\gamma$ -radiations.

D-17.

1.

D-13.

**Sol.**  $5O_3 + I_2 + H_2O \longrightarrow 2HIO_3 + 5O_2$ 

# Exercise-2

## **OBJECTIVE QUESTIONS(TOUGH LEVEL)**



Nitrogen uses three p-orbitals and one s-orbital for making bonds as it does not have d-orbital.

2. Sol. It is 2nd period element which does not contain d-orbitals.

Dt

3. Sol.  $Al_2O_3 + 3C + N_2 \longrightarrow 2AlN + 3CO$ 

 $2AIN + 3H_2O \longrightarrow AI(OH)_3 + NH_3$ 

4. Sol. 
$$4NH_3 + 5O_2 \xrightarrow{800^{\circ}C} 4NO + 6H_2O$$
 (Ostwald's process of mfg. HNO<sub>3</sub>).

5. Sol. 
$$2NO_2 + H_2O \longrightarrow HNO_2 + HNO_3$$

- 6. Sol. Vanderwaal's forces increase as we move down the group and hydrogen bonding is present in NH<sub>3</sub>.
- 7. Sol. (1) It is slightly soluble in water ; the aqueous solution being neutral.

(2) The solution of  $PH_3$  in water decomposes in presence of light giving red phosphorus and  $H_2$ .

(3) Phosphonium compounds are obtained when anhydrous phosphine reacts with anhydrous halogen acids (not in aqueous solution).

(4) Containers containing calcium carbide and calcium phosphide are pierced and thrown in the sea when the gases evolved burn and serve as a signal.

- 8. Sol. The spontaneous combustion of phosphine is technically used in Holme's samples. Containers containing calcium carbide and calcium phosphide are pierced and thrown in the sea when the gases evolved burn and serve as a signal.
- 9. Sol.  $P_4O_6 + 6H_2O \longrightarrow 4H_3PO_3$

 $P_4O_{10} + H_2O$  $H_3PO_3 + Br_2$ , heat in a sealed tube. White  $P_4$  + Alkali

- 10. Sol:
- **11.** Sol.  $PCI_3 + 3H_2O \longrightarrow H_3PO_3 + 3HCI$
- **12.** Sol.  $P_4 + 3OH^- + 3H_2O \longrightarrow PH_3 + 3H_2PO_2^-$
- 13. Sol: Both are correct statements but Reason is not correct explanation of Assertion .

#### Group 16<sup>th</sup>

16<sup>th</sup> oxZ

- **15. Sol.** All statements are correct.
- **16. Sol.** (1) Neutralisation reaction
  - (2) Addition reaction
  - (3) SO<sub>2</sub> reduces Fe<sup>3+</sup> to Fe<sup>2+</sup> and itself oxidised to SO<sub>4</sub><sup>2-</sup>.
  - (4) SO<sub>2</sub> acts as oxidising agent.
- **17.** Sol. Down the group bond (H E) dissociation enthalpy decreases as (H E) bond length increases and thus thermal stability of hydrides also decreases.
- **18. Sol.** Oxygen is soluble in alkaline pyrogallol and ozone dissolves in oil of cinnamon.

#### 19.

- **Sol.** All three compounds act as bleaching agents ; SO<sub>2</sub> through reduction process whereas H<sub>2</sub>O<sub>2</sub> and O<sub>3</sub> through oxidation process.
- **20.** Sol.  $SO_2 + 2H_2O \longrightarrow H_2SO_4 + 2H$ coloured matter Oxidation colourless matter.
- **21.** Sol. It dissolves in water forming H<sub>2</sub>SO<sub>3</sub>.
- 22. Sol. (1)  $SO_2 + Cl_2 \xrightarrow{charcoal} \xrightarrow{plj d lg} SO_2Cl_2$ (2)  $Cl_2 + SO_2 + 2H_2O \longrightarrow 2HCl + H_2SO_4$ (3)  $3Mg + SO_2 \longrightarrow 2MgO + MgS$ ;  $4K + 3SO_2 \longrightarrow K_2SO_3 + K_2S_2O_3$



**Exercise-3** 

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

#### **OFFLINE JEE-MAIN**

- **1. Sol.** Polyphosphate sequesters  $Ca^{2+}$  and  $Mg^{2+}$  (present in hard water) and forms soluble complexes with  $Ca^{2+}$  and  $Mg^{2+}$  which do not precipitate with  $CO_3^{2-}$  and soap.
- **2.** Sol.  $H_3PO_2$  is monobasic and acts as reducing agent.

It has two reducing hydrogen and one ionizable hydrogen, so monobasic and reducing.

**3. Sol.** It is peroxodisulphuric acid, the Marshall's acid and contains one -O-O- linkage as given in structure





4. Sol.

P<sub>4</sub> has angle strain as there is much deviation in bond angle (60°) from the normal tetrahedral bond angle of 109.5°. So it is most unstable, therefore, most reactive.

5.

Sol.

6.



Number of hydrogen atom(s) attached to phosphorus atom is 2 which are called as reducing hydrogen.



7. Sol. 
$$(NH_4)_2SO_4 + 2H_2O \rightarrow (2H^+ + SO_4^{2-}) + 2NH_4OH$$
  
Strong acid Weakbase

 $(NH_4)_2$  SO<sub>4</sub> on hydrolysis produces strong acid H<sub>2</sub>SO<sub>4</sub>, which increases the acidity of the soil.

#### **8.\* Ans.** (1) or (4)

Sol.

**Sol.** The stability of hydrides decreases from  $NH_3$  to  $BiH_3$  which can be observed from their bond dissociation enthalpy. The correct order is  $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$ .

Property	NH₃	PH₃	AsH₃	SbH₃	BiH₃
Δ <sub>diss</sub> H <sup>Θ</sup> (E–H) / kJ mol <sup>−1</sup>	389	322	297	255	-

#### **Alternate Solution**

 $N_2O_4$  may has four resonating structure but in NCERT only two resonating structure . Resonating structures of  $N_2O_4\,$  are



- **9. Sol.** Sulphur exhibit + 2, + 4, + 6 oxidation states but + 4 and + 6 are more common.
- **10. Ans.** (All statement are correct there is no answer).

**Sol.** (1) ONCI = 8 + 7 + 17 = 32e<sup>-</sup>

ONO<sup>-</sup> = 8 + 7 + 8 + 1 = 24e<sup>-</sup> (correct)

- (2)  $0^{-1}$  Central atom O is sp<sup>2</sup> hybridised with 1 lone pair, so bent shape (correct)
- (3) Ozone is violet-black in solid state. (Ref. NCERT & shriver atkins)
- (4) O<sub>3</sub> has no unpaired electrons, so diamagnetic (correct)

- **11. Sol.** NO is paramagnetic in gaseous state.
- **12. Sol.**  $H_2O_2$  can undergo reduction as well as oxidation because oxidation number of oxygen in  $H_2O_2$  is -1. So, it can act both as reducing agent and oxidising agent.

Orthophosphorous acid 
$$\left(H_3^{+3}PO_3\right)$$

Pyrophosphorous acid

$$\left(H_2 \overset{+3}{P_2} O_5\right)$$

**15.** Sol.  $Zn + HNO_3$  (dil.)  $\longrightarrow Zn(NO_3)_2$  (aq) + N<sub>2</sub>O + H<sub>2</sub>O  $Zn + HNO_3$  (conc.)  $\longrightarrow Zn(NO_3)_2 + NO_2 + H_2O$ 

### **ONLINE JEE-MAIN**

5. Sol. Fact

Sol.

Sol. PbS is reducing agent because it getting oxidise in to PbSO<sub>4</sub>. H<sub>2</sub>O<sub>2</sub> is oxidizing agent reduce in to H<sub>2</sub>O

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

\* Marked Questions may have more than one correct option. Section (A) : Group 15th

1.

14.



Sol.

According to the structure of cyclic metaphosphoric acid,  $(HPO_3)_3$ , there are three P – O – P bonds.

- 2. Sol. As non-metallic character of element attached to oxygen atom increases, the difference between the electronegativity values of element and oxygen decreases and the acid character of oxides increases and vice-versa.
- **3. Sol.** It reacts with conc. H<sub>2</sub>SO<sub>4</sub>, P<sub>4</sub>O<sub>10</sub> and anhydrous CaCl<sub>2</sub> but not with CaO.

 $2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$   $P_4O_{10} + 12NH_3 \longrightarrow 4(NH_4)_3PO_4 + 6H_2O.$   $CaCl_2 + 8NH_3 \longrightarrow CaCl_2.8NH_3.$   $CaO + H_2O \longrightarrow Ca(OH)_2.$ 

**4. Sol.** It sequesters  $Ca^{2+}$  and  $Mg^{2+}$  (present in hard water) and forms soluble complex with  $Ca^{2+}$  and  $Mg^{2+}$  which do not precipitate with  $CO_3^{2-}$  and soap.

- 5. Sol. In H<sub>3</sub>PO<sub>3</sub>, there are two OH<sup>-</sup> groups i.e. there are two ionisable protons. So it is diabasic in nature. The hydrogen which is directly attached to phosphorus atom is called as reducing hydrogen. As H<sub>3</sub>PO<sub>3</sub> contains one P–H bond it acts as a reducing agent.
- 6. Sol.  $(NH_4)_2Cr_2O_7 \longrightarrow N_2 + Cr_2O_3 + 4H_2O$ . N<sub>2</sub> gas is also given by NH<sub>4</sub>NO<sub>2</sub>.

 $NH_4NO_2 \longrightarrow N_2 + 2H_2O.$ 

 $NH_4NO_3 \longrightarrow N_2O + 2H_2O.$ 

- 7. Sol. NO + NO<sub>2</sub>  $\xrightarrow{-30^{\circ}C}$  N<sub>2</sub>O<sub>3</sub>( $\ell$ ) pale blue
- 8. Sol. Black phosphours has layered structure like graphite and has highest ignition temperature (> 673 K).



- 9. Sol. Because of following two reasons, the nitrates are less abundant in earth crust.
  (i) Nitrates have greater solubility in water.
  (ii) Nitrates are prone to microbial action.
- **10. Sol.** NH<sub>3</sub> is better electron donor as the lone pair of electrons are present in diffued and more directional sp<sup>3</sup> hybridised orbital. In PH<sub>3</sub> the lone pair of electrons is supposed to be present in more concentrated s-orbital which is closer to the nucleus. As a result the donation of electron pair is some what difficult.
- **11. Sol.** It is disproportionation reaction,

 $\stackrel{0}{\mathsf{P}_4}$  + 3NaOH + 3H<sub>2</sub>O  $\rightarrow$  3NaH<sub>2</sub> $\stackrel{5_+}{\mathsf{P}}$ O<sub>2</sub> +  $\stackrel{3_-}{\mathsf{P}}$ H<sub>3</sub>

**12.** Sol.  $P_4 + 3O_2 \xrightarrow{\text{In presence of } N_2} P_4O_6$ . Here nitrogen acts as diluent. Note :

In dry O<sub>2</sub> following reactions may take place.

 $\mathsf{P}_4 + 3\mathsf{O}_2 \longrightarrow \mathsf{P}_4\mathsf{O}_6.$ 

$$\mathsf{P}_4\mathsf{O}_6 + 2\mathsf{O}_2 \longrightarrow \mathsf{P}_4\mathsf{O}_{10}.$$

In moist  $O_2$  the  $P_4O_6$  gets hydrolysed forming  $H_3PO_3$ .

	$P_4O_6 + 6H_2O \longrightarrow 4H_3PO_3.$						
	In presence of NaOH.						
	$P_4 + 3OH^- + 3H_2O \longrightarrow PH_3 + 3H_2PO_2^-$						
13.	Ans.	$A \rightarrow p, s \ ; \ B \rightarrow$	q, s; C $\rightarrow$ r, t; D $\rightarrow$ q, t				
Sol.	(A) $3Cu + 8HNO_3$ (dilute) $\longrightarrow$ $2NO + Cu(NO_3)_2 + 4H_2O$						
	(B) Cu + 4HNO <sub>3</sub> (concentrated) $\longrightarrow$ 2NO <sub>2</sub> + Cu(NO <sub>3</sub> ) <sub>2</sub> + 2H <sub>2</sub> O						
	(C) 4Zn + 10HNO <sub>3</sub> (dilute) → 4Zn(NO <sub>3</sub> ) <sub>2</sub> + N <sub>2</sub> O + 5H <sub>2</sub> O						
	(D) Zn + 4HNO <sub>3</sub> (concentrated) $\longrightarrow$ Zn(NO <sub>3</sub> ) <sub>2</sub> + 2NO <sub>2</sub> + 2H <sub>2</sub> O						
14.	Sol. Ba $(N_3)_2(s) \xrightarrow{\Delta}$ Ba $(s) + 3N_2(g)$						
15.	Ans.	(B)					
Sol.	Compo	bund	Oxidation state of Nitrogen				
	HNO <sub>3</sub>		= + 5				
	NO		= +2				
	NH <sub>4</sub> CI		= -3				
	N <sub>2</sub>		= 0				

So, correct order will be HNO<sub>3</sub>, NO, N<sub>2</sub>, NH<sub>4</sub>CI

#### Section (B) : Group 16th

**16. Sol.** Intermolecular forces between  $H_2S$ ,  $H_2Se$  and  $H_2Te$  molecules are purely Van der Waal's force of attraction while in water there is stronger H-bonding between the water molecules. H-bond is stronger than Van der Waal's force of attraction and thus more energy is required for converting  $H_2O(\ell)$  to  $(H_2O)(g)$ .



17. Sol.

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

**18. Sol.** It is peroxodisulphuric acid, the Marshall's acid and contains one – O – O – linkage as given in structure



**19.** Sol. Mn in KMnO<sub>4</sub> is in highest oxidation state can not be oxidised. I<sup>-</sup>, MnO<sub>4</sub><sup>2-</sup> and Fe<sup>2+</sup> can be oxidised to I<sub>2</sub>, MnO<sub>4</sub><sup>-</sup> and Fe<sup>3+</sup> respectively by O<sub>3</sub>.

- **20.** Sol.  $PbO_2 + 4HNO_3 \longrightarrow Pb(NO_3)_2 + 2NO_2 + 2H_2O + O_2$ .
- **21.** Sol.  $Na_2S_2O_3 + 4Cl_2 + 5H_2O \longrightarrow 2NaHSO_4 + 8 HCl$ It destroys the chlorine present in fibres during dyeing. That is why the  $Na_2S_2O_3$  is called as antichlor.
- 23. Sol.  $KIO_4 + H_2O_2 \rightarrow KIO_3 + H_2O + O_2$ H<sub>2</sub>O<sub>2</sub> acts as a reductant 2NH<sub>2</sub>OH + H<sub>2</sub>O<sub>2</sub>  $\rightarrow$  N<sub>2</sub> + 4H<sub>2</sub>O H<sub>2</sub>O<sub>2</sub> acts as an oxidant.
- **24.** Sol.  $P_4 + 8SOCl_2 \rightarrow 4PCl_3 + 4SO_2 S_2Cl_2$

#### PARAGRAPH-1

26. Sol. (25 & 26)  

$$\xrightarrow{\Delta} KCI + O_{2} (W)$$

$$P_{4} + O_{2} \longrightarrow P_{4}O_{10} (White) + (excess) \longrightarrow P_{4}O_{10} (X)$$

$$P_{4}O_{10} + HNO_{3} \longrightarrow N_{2}O_{5} + HPO_{3} (Z)$$

### Additional Problems For Self Practice (APSP)

### **PART - I : PRACTICE TEST PAPER**

- **1. Sol.** Poor shielding by f-and d- electrons enhences the effective nuclear charge in Bi. This causes contraction in size.
- **4. Sol.** (1) (NH<sub>4</sub>)NO<sub>3</sub> gives N<sub>2</sub>O, (2) chlorine (excess) with liquor NH<sub>3</sub> forms NCl<sub>3</sub> and (4) Pb(NO<sub>3</sub>)<sub>2</sub> gives NO<sub>2</sub> not N<sub>2</sub> on heating.

(3) 5Cu (red hot) + 2HNO<sub>3</sub>  $\longrightarrow$  5CuO + N<sub>2</sub>  $\uparrow$  + H<sub>2</sub>O

- **5. Sol.** PH<sub>3</sub> is less basic than NH<sub>3</sub> due to lesser availability of lone pair of electrons. The lone pair of electron is present in spherical s-orbital as compared to directional sp<sub>3</sub> hybrid orbital in NH<sub>3</sub>.
- 6. Sol.  $2Ca_3(PO_4)_2$  (from bone-ash) +  $10C + 6SiO_2 \xrightarrow{\Delta} 6CaSiO_3 + 10CO + P_4(s)$  white phosphorus

- 9. Sol. Both rhombic & monoclinic sulphur has crown shape.
- **10. Sol.** Tailing of mercury.
- **11. Sol.** The order of boiling point of hydride of oxygen family is  $H_2O > H_2Te > H_2Se > H_2S$ .
- **12. Sol.** The oxidation state of copper changes from +2 to 0 i.e. it gets reduced. So, NH<sub>3</sub> works as a reducing agent.
- **13.** Sol.  $P_4 + 3NaOH + 3H_2O \xrightarrow{\Delta} PH_3 + 3NaH_2PO_2$
- **14.** Sol.  $CaO + 2C + N_2 \xrightarrow{2000^{\circ}C} CaCN_2 + CO\uparrow$ ;  $CaCN_2 + 3H_2O \xrightarrow{} CaCO_3 + 2NH_3\uparrow$  (calcium cynamide)
- **15.** Sol.  $NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$

**16.** Sol.  $Fe_{2+} + NO + 5H_2O \longrightarrow [Fe(H_2O)_5NO]_{2+}$  (brown complex).

**17.** Sol. CHCl<sub>3</sub> (chloroform) react with conc. HNO<sub>3</sub> on heating to form chloropicrin (CCl<sub>3</sub>NO<sub>2</sub>) CHCl<sub>3</sub> + HONO<sub>2</sub>  $\rightarrow$  CCl<sub>3</sub>. NO<sub>2</sub> + H<sub>2</sub>O Chloropicrin

Chloropicrin is used as an insecticide and also war gas. It is also known as nitrochloroform or tear gas.



# Practice Test Paper (JEE-Main Pattern)

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. Ans:  $2HNO_3 \rightarrow 2NO_2 + H_2O + O$   $2Ag + 2HNO_3 + O \rightarrow 2AgNO_3 + H_2O$ (adding)  $2Ag + 4HNO_3 \rightarrow 2NO_2 + 2AgNO_3 + 2H_2O$ (conc.) if dil. HNO\_3 is used, NO is produced.
- **2. Sol.** Inert pair effect (B) (J.D. Lee)  $\rightarrow$  TeO<sub>2</sub> is amphoteric and dissolves in alkali to form tellurites and also dissolves in acids to form basic salts.
- 3. Sol.  $H_2S + H_2SO_4 \longrightarrow 2H_2O + SO_2 + S$
- 4. Sol.  $3S + H_2SO_4 \longrightarrow 3SO_2 + 2H_2O$
- 5. Sol.  $NH_4CIO_4 + HNO_3 \longrightarrow HCIO_4 + NH_4NO_3$  $2NH_4NO_3 \xrightarrow{\Delta} 2N_2O + 4H_2O$

8. Ammonia can be dried by : (1) conc.  $H_2SO_4$  (2)  $P_4O_{10}$  (3) anhydrous CaCl<sub>2</sub> (4\*) none veksfu;k dks 'kq"dhdj.k fuEu }kjk fd;k tk ldrk gS (1) lkanz  $H_2SO_4$  (2)  $P_4O_{10}$  (3) futZy CaCl<sub>2</sub> (4\*) dksbZ ugha

**Sol.** CaO + H<sub>2</sub>O 
$$\longrightarrow$$
 Ca(OH)<sub>2</sub>

9. Sol.  $(H_3PO_4)$  O HO HOHO

Strength of phosphorus oxy acid depends upon the number of OH groups per P = O group, more the OH group less will be the electronic withdrowing effect of P = O group. It is the P = O group which induces polarisation and helps in the release of proton from-OH group.  $H_3PO_3 > H_3PO_4$ 

- **10. Sol.** (3) oxygen gas is produced.
- **11. Sol.** In H<sub>2</sub>SO<sub>4</sub>, intense H-bonding makes it less volatile than HCl. HCl is more volatile as there is no H-bonding. So H<sub>2</sub>SO<sub>4</sub> displaces HCl from its salt.
- **12. Sol.** During oxidation of H<sub>2</sub>O<sub>2</sub>, O–O bond is not broken.
- **13.** Sol.  $2Na_2S(aq) + 3SO_2(g) \longrightarrow S^{\downarrow} + Na_2S_2O_3(aq)$
- **14.** Sol.  $PbO_2 + 2HNO_3 \longrightarrow Pb(NO_3)_2 + 1/2 O_2 + H_2O_3$

 $2\mathsf{MnO}_2 + 2\mathsf{H}_2\mathsf{SO}_4 \longrightarrow 2\mathsf{MnSO}_4 + \mathsf{H}_2\mathsf{O} + \mathsf{O}_2$ 

 $2 \text{ KMNO}_4 + 16 \text{HCl} \longrightarrow 2 \text{KCl} + 2 \text{MnCl}_2 + 8 \text{H}_2 \text{O} + 5 \text{Cl}_2$ 

**15.** Sol. With  $K_2Cr_2O_7$  :  $Cr_2O_{72-} + 2H_+ + 4H_2O_2 \xrightarrow{\text{amyl alcohol}} 2CrO_5 + 5H_2O$ CrO<sub>5</sub> bright blue coloured compound soluble in diethyl ether, amyl alcohol and amyl acetate.

$$CrO_5 + H_2SO_4 \longrightarrow 2Cr_2(SO_4)_3 + 6H_2O + 7O_2$$

- **16.** Sol.  $K_4Fe(CN)_6$  oxidises to  $K_3Fe(CN)_6$  in basic medium.
- **17. Sol.** A filter paper soaked in a alcoholic benzidine  $\begin{bmatrix} H_2 N \bigcirc NH_2 \end{bmatrix}$  becomes brown when brought in contact with O<sub>3</sub> (this is not shown by  $H_2O_2$ )
- **19.** Sol.  $P_4 \xrightarrow{250^{\circ}C \text{ or}}$  Red phosphorus. J.D. Lee)

(Source :



- 22. Sol.
- **25.** Sol. Mn is in +6 oxidation state and can be oxidised to +7, remaining salts can not be oxidised as central atoms are in their highest oxidation states.
- **27. Sol.** -1 +6 0 +4

 $2HI + H_2SO_4 \longrightarrow I_2 + SO_2 + 2H_2O$ Thus H\_2SO\_4 oxidises HI to I\_2.

28. Sol. (1), (2) and (4) are correct statements. (3) red phosphours is insoluble in H<sub>2</sub>O as well as CS<sub>2</sub>.

**29.** Sol. 
$$3CuSO_4 + 2PH_3 \longrightarrow Cu_3P_2 + 3H_2SO_4$$