



Additional Problems for Self Practice (APSP)

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

PART - I : PRACTICE TEST-1 (IIT-JEE (MAIN Pattern))

Max. Marks : 100

Max. Time : 1 Hr.

Important Instructions :

1. The test is of **1 hour** duration.
2. The Test Booklet consists of **25** questions. The maximum marks are **100**.
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.
 $\frac{1}{4}$ (**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. **Test Paper consists of Two (2) Sections.**
Section-1 contains **20** multiple choice questions. Each question has four choices (1), (2), (3) and (4) out of which **one** is correct. For each question in Section-1, you will be awarded 4 marks if you give the corresponding to the correct answer and zero mark if no given answers. In all other cases, minus one (**-1**) mark will be awarded.
Section-2 contains **5** questions. The answer to each of the question is a **Numerical Value**. For each question in Section-2, you will be awarded 4 marks if you give the corresponding to the correct answer and zero mark if no given answers. No negative marks will be answered for incorrect answer in this section. In this section answer to each question is **NUMERICAL VALUE** with two digit integer and decimal upto two digit. If the numerical value has more than two decimal places **truncate/round-off** the value to **TWO** decimal placed.

SECTION-1

This section contains **20** multiple choice questions. Each questions has four choices (1), (2), (3) and (4) out of which Only **ONE** option is correct.

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 electronegativity of Sb and Bi.
 (3) the Bi being last element of the group.
 (4) similar densities of Sb and Bi.
2. 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.
3. Phosphorus is manufactured by heating in an electric furnace a mixture of
 (1) Bone ash and coke
 (2) Bone ash and silica
 (3) Bone ash, silica and coke
 (4) None of these
4. Which of the following may ignite spontaneously in air ?
 (1) White phosphorus (2) Red phosphorus (3) Black phosphorus (4) Nitrogen
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
6. Crown shape of S_8 molecule is present in :
 (1) Rhombic sulphur
 (2) Monoclinic sulphur
 (3) Both (1) & (2)
 (4) None of these



7. Presence of ozone in a gas sample may be detected by :
 (1) H_2O_2 (2) SO_2 (3) Hg (4) KI
8. 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
9. 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
10. 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 110°C
 (4) By heating red phosphorus with an aqueous solution of caustic soda.
11. 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
12. 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
13. Formula for tear gas is :
 (1) COCl_2 (2) CCl_3NO_2 (3) N_2O (4) None of these
14. In the reaction, $\text{conc. H}_2\text{SO}_4 + \text{P}_2\text{O}_5 \xrightarrow{\Delta} (\text{X}) + \text{SO}_3$; the major product (X) is :
 (1) PH_3 (2) H_3PO_4 (3) HPO_3 (4) $\text{H}_4\text{P}_2\text{O}_7$
15. Ortho phosphoric acid on heating above 300°C gives :
 (1) hypophosphorus acid (2) hypophosphoric acid
 (3) metaphosphoric acid (4) phosphorous acid
16. 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
17. Which of the following dissolves in water but does not give any oxyacid solution ?
 (1) SO_2 (2) OF_2 (3) SCl_4 (4) SO_3
18. 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
19. Sulphur on boiling with NaOH solution gives
 (1) $\text{Na}_2\text{S}_2\text{O}_3 + \text{NaHSO}_3$ (2) $\text{Na}_2\text{S}_2\text{O}_3 + \text{Na}_2\text{S}$
 (3) $\text{Na}_2\text{SO}_3 + \text{H}_2\text{S}$ (4) $\text{Na}_2\text{SO}_3 + \text{SO}_2$
20. Sodium thiosulphate is prepared by
 (1) reducing Na_2SO_3 solution with H_2S (2) Boiling Na_2SO_3 with S in alkaline medium.
 (3) Neutralising $\text{H}_2\text{S}_2\text{O}_3$ solution with NaOH (4) Boiling Na_2SO_3 with S in an acidic medium

SECTION-2

This section contains 5 questions. Each question, when worked out will result in Numerical Value.

21. When I_2 react with ozone formed a oxy compound. Then find the oxidation state of iodine in that oxy compound



22. How many moles of H^+ ions are released when Cu^{2+} ion react with PH_3 in presence of H_2O ?
23. How many of the following compounds have M-O-M type bonds (where M represent any element)?
 (i) P_2O_5 (ii) P_4O_{10} (iii) N_2O_5 (iv) N_2O_3 (v) As_4O_6
 (vi) Bi_2O_3 (vii) $H_2S_2O_8$ (viii) $H_2S_2O_7$ (ix) H_2SO_5 (x) $H_2S_2O_3$
24. How many S-O-S bonds are present in the trimer of SO_3 ?
25. When one mole of SO_3 react with one mole of PCl_5 then how many moles of gaseous products are formed?

Practice Test-1 (IIT-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					
Ans.										

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

1. The substance used in holmes singnals of the ship is a mixture of : [AIEEE-2003, 3/225]
 (1) $CaC_2 + Ca_3P_2$ (2) $Ca_3(PO_4)_2 + Pb_3O_4$ (3) $H_3PO_4 + CaCl_2$ (4) $NH_3 + HOCl$
2. 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
3. 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) $2PCl_5 + H_2SO_4 \rightarrow 2POCl_3 + 2HCl + SO_2Cl_2$
4. 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
- 5.* 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
6. Which of the following statements regarding sulphur is **incorrect** ? [AIEEE 2011, 4/120]
 (1) S_2 molecule is paramagnetic.
 (2) The vapour at $200^\circ C$ consists mostly of S_8 rings.
 (3) At $600^\circ C$ the gas mainly consists of S_2 molecules.
 (4) The oxidation state of sulphur is never less than +4 in its compounds.
7. 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.



8. Which of the following properties is not shown by NO ? [JEE(Main) 2014, 4/120]
 (1) It is diamagnetic in gaseous state
 (2) It is a neutral oxide
 (3) It combines with oxygen to form nitrogen dioxide
 (4) Its bond order is 2.5
9. From the following statements regarding H₂O₂, 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
10. **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
11. 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
12. The reaction of zinc with dilute and concentrated nitric acid, respectively, produces: [JEE(Main) 2016, 4/120]
 (1) NO₂ and NO (2) NO and N₂O (3) NO₂ and N₂O (4) N₂O and NO₂
13. Hydrogen peroxide oxidises [Fe(CN)₆]⁴⁻ to [Fe(CN)₆]³⁻ in acidic medium but reduces [Fe(CN)₆]³⁻ to [Fe(CN)₆]⁴⁻ in alkaline medium. The other products formed are, respectively. [JEE(Main) 2018, 4/120]
 (1) H₂O and (H₂O + O₂) (2) H₂O and (H₂O + OH⁻)
 (3) (H₂O + O₂) and H₂O (4) (H₂O + O₂) and (H₂O + OH⁻)
14. The compound that does not produce nitrogen gas by the thermal decomposition is : [JEE(Main) 2018, 4/120]
 (1) NH₄NO₂ (2) (NH₄)₂SO₄ (3) Ba(N₃)₂ (4) (NH₄)₂Cr₂O₇

PART - II : NATIONAL STANDARD EXAMINATION IN CHEMISTRY (NSEC) STAGE-I

1. Which element of group V A shows maximum oxidation states ? [NSEC-2002]
 (A) bismuth (B) phosphorus (C) nitrogen (D) arsenic
2. Which of the halide is unstable ? [NSEC-2002]
 (A) NI₃ (B) AsI₃ (C) BiI₃ (D) PI₃
3. Platinum metal (Pt) dissolves in aqua- regia but not in concentrated HCl or HNO₃ because [NSEC-2003]
 (A) HCl oxidises Pt in the presence of HNO₃
 (B) HNO₃ reacts with HCl to form chlorine which attacks Pt
 (C) HNO₃ oxidises Pt which is followed by formation of a chloro complex
 (D) HCl and HNO₃ together give O₂ that oxidises Pt.
4. The reaction 3O_{2(g)} → 2O_{3(g)} is endothermic. What can be concluded about the average per bond in O₂ and O₃? [NSEC-2003]
 (A) the average energy per bond in O₂ greater than that in O₃
 (B) the average energy per bond in O₂ is less than in O₃
 (C) the average energy per bond in O₂ is equal to that in O₃
 (D) on conclusions can be drawn about the average bond energies from this information alone.



5. The anhydride of nitric acid is [NSEC-2003]
 (A) nitric oxide (B) nitrous oxide
 (C) dinitrogen trioxide (D) dinitrogen pentoxide.
6. The geometry of ammonia molecule can be best described as [NSEC-2003]
 (A) nitrogen at one vertex of a regular tetrahedron, the other three vertices being occupied by the three hydrogens
 (B) nitrogen at the centre of the tetrahedron, three of the vertices being occupied by three hydrogens
 (C) nitrogen at the centre of an equilateral triangle, three corners being occupied by three hydrogens
 (D) nitrogen at the junction of a T, three open ends being occupied by three hydrogens.
7. Bones glow in the dark. This is due to [NSEC-2005]
 (A) the presence of red phosphorus.
 (B) conversion of white phosphorus into red phosphorus.
 (C) the presence of calcium carbonate
 (D) the presence of calcium phosphate.
8. Inert pair effect plays an important role in the case of [NSEC-2005]
 (A) P (B) Bi (C) Sb (D) As
9. In the presence of an anthraquinone derivative as a catalyst, the aqueous solution of sodium dithionite $\text{Na}_2\text{S}_2\text{O}_4$ (Fieser's solution) effectively removes oxygen and forms [NSEC-2006]
 (A) $\text{Na}_2\text{S}_2\text{O}_6$ (B) $\text{Na}_2\text{S}_2\text{O}_5$ (C) Na_2SO_4 (D) $\text{Na}_2\text{S}_2\text{O}_8$.
10. In the above reaction (in Q. 99) $\text{Na}_2\text{S}_2\text{O}_4$ acts as a [NSEC-2006]
 (A) 2 electron reducing agent (B) 1 electron reducing agent
 (C) 3 electron reducing agent (D) 4 electron reducing agent.
11. The ozone hole in the upper atmosphere of the earth is due to the breakdown of ozone to oxygen. The reaction is catalyzed by – [NSEC-2009]
 (A) chlorofluorocarbons
 (B) oxygen generated during the reaction
 (C) carbon dioxide present in the atmosphere
 (D) chlorine formed by the decomposition of chlorofluorocarbons
12. The electron-pair geometry of the central oxygen atom of ozone is – [NSEC-2009]
 (A) linear (B) trigonal planar (C) tetrahedral (D) trigonal bipyramidal
13. $\text{P}_4(\text{s}) + 3\text{OH}^-(\text{aq}) + 3\text{H}_2\text{O}(\text{l}) \longrightarrow \text{PH}_3(\text{g}) + 3\text{H}_2\text{PO}_2^-(\text{aq})$ [NSEC-2009]
 In the above equation, the species getting oxidized and reduced respectively are :
 (A) P_4 and OH^- (B) OH^- and P_4 (C) P_4 and H_2O (D) P_4 and P_4
14. The compound which can act as an oxidizing agent as well as reducing agent is [NSEC-2010]
 (A) HNO_2 (B) HI (C) HCN (D) HCOOH
15. When an inert atmosphere is required in metallurgical operation nitrogen is commonly used. However in the extraction of titanium from TiCl_4 using magnesium, helium is used as nitrogen reacts with : [NSEC-2010]
 (A) TiCl_4 to form titanium nitride
 (B) magnesium to form magnesium nitride
 (C) titanium to form titanium nitride
 (D) chlorine to form nitrogen chloride which inhibits the reaction
16. The nitrogen compound formed when CaCN_2 reacts with steam or hot water is [NSEC-2011]
 (A) N_2O (B) NO (C) NO_2 (D) NH_3
17. The element that has the highest tendency to catenate is : [NSEC-2011]
 (A) silicon (B) germanium (C) sulphur (D) boron
18. The chemical formula of 'laughing gas' is [NSEC-2012]
 (A) NO (B) N_2O (C) N_2O_4 (D) N_2O_5
19. Phosphine is prepared by the reaction of [NSEC-2012]
 (A) P and HNO_3 (B) P and H_2SO_4 (C) P and NaOH (D) P and H_2S



20. The reddish-brown gas formed when nitric oxide is oxidized by air is [NSEC-2013]
(A) NO_2 (B) N_2O_4 (C) N_2O_5 (D) N_2O_3
21. Which of the following salt/s of H_3PO_3 exists ? [NSEC-2013]
(I) NaH_2PO_3 (II) Na_2HPO_3 (III) Na_3PO_3
(A) I and II only (B) I, II and III (C) II and III only (D) III only
22. The order of acidity in aqueous solution for the following acids is [NSEC-2014]
(A) $\text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$ (B) $\text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{Te}$ (C) $\text{H}_2\text{Te} < \text{H}_2\text{S} < \text{H}_2\text{Se}$ (D) $\text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{S}$
23. Upon long standing concentrated HNO_3 [NSEC-2014]
(A) remains colourless, but gives out NO
(B) turns yellow brown due to formation NO_2
(C) turns yellow brown due to the formation of N_2O_4
(D) remains colourless, but gives N_2O
24. The reaction that does not produce nitrogen is [NSEC-2015]
(A) heating $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ (B) NH_3 + excess of Cl_2
(C) heating of NaN_3 (D) heating of NH_4NO_3
25. White phosphorous on reaction with NaOH gives PH_3 and [NSEC-2016]
(A) Na_2HPO_3 (B) NaH_2PO_2 (C) NaH_2PO_3 (D) Na_3PO_4
26. P, Q, R and S are four metals whose typical reactions are given below : [NSEC-2016]
(I) Only Q and R react with dilute HCl to give H_2 gas.
(II) When Q is added to a solution containing the ions of the other metals, metallic P, R and S are formed.
(III) P reacts with concentrated HNO_3 but S does not
The correct order of their reducing character is :
(A) $\text{S} < \text{P} < \text{R} < \text{Q}$ (B) $\text{S} < \text{R} < \text{P} < \text{Q}$ (C) $\text{R} < \text{Q} < \text{P} < \text{S}$ (D) $\text{Q} < \text{P} < \text{S} < \text{R}$
27. The following compounds are heated (i) KNO_3 , (ii) $\text{Cu}(\text{NO}_3)_2$ (iii) $\text{Pb}(\text{NO}_3)_2$, (iv) NH_4NO_3 . Which of the following statement/s is/are correct ? [NSEC-2016]
(A) (ii) and (iii) liberate NO_2 (B) (iv) liberates N_2O
(C) (i), (ii) and (iii) liberate O_2 (D) All statements are correct.
28. At 25°C , nitrogen exists as N_2 and phosphorous exists as P_4 because [NSEC-2017]
(A) N_2 has valence electrons only in bonding and nonbonding orbitals, while P has valence electrons in both bonding and antibonding orbitals
(B) higher electronegativity of N favours formation of multiple bonds
(C) bigger size of P does not favour multiple bonds
(D) P has preference to adapt structures with small bond angles
29. Which of the following cannot act as an oxidising agent ? [NSEC-2017]
(A) S^{2-} (B) Br_2 (C) HSO_4^- (D) SO_3^{2-}

PART - III : PRACTICE TEST-2 (IIT-JEE (ADVANCED Pattern))

Max. Time : 1 Hr.

Max. Marks : 69

Important Instructions

A. General :

- The test is of 1 hour duration.
- The Test Booklet consists of 23 questions. The maximum marks are 69.

B. Question Paper Format

- Each part consists of five sections.
- Section-1 contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE is correct.
- Section-2 contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE OR MORE THAN ONE are correct.



6. Section-3 contains 6 questions. The answer to each of the questions is numerical value, ranging from 0 to 9 (both inclusive).
7. Section-4 contains 1 paragraphs each describing theory, experiment and data etc. 2 questions relate to paragraph. Each question pertaining to a particular passage should have only one correct answer among the four given choices (A), (B), (C) and (D).
8. Section-5 contains 1 multiple choice questions. Question has two lists (list-1 : P, Q, R and S; List-2 : 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which ONLY ONE is correct.

C. Marking Scheme :

9. For each question in Section-1, 4 and 5 you will be awarded 3 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, minus one (– 1) mark will be awarded.
10. For each question in Section-2, you will be awarded 3 marks. If you darken all the bubble(s) corresponding to the correct answer(s) and zero mark. If no bubbles are darkened. No negative marks will be answered for incorrect answer in this section.
11. For each question in Section-3, you will be awarded 3 marks if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. No negative marks will be awarded for incorrect answer in this section.

SECTION-1 : (Only One option correct Type)

This section contains 8 multiple choice questions. Each questions has four choices (A), (B), (C) and (D) out of which Only ONE option is correct.

1. An unknown substance (P) functions as weak base in water. It produces silver mirror test. It reacts with dilute HCl to produce (Q) which turns blue litmus red. (P) may be :
(A) NH_3 (B) PH_3 (C) NH_2OH (D) HPO_3
2. The compound which gives off oxygen on moderate heating is :
(A) Cupric oxide (B) Mercuric oxide (C) Zinc oxide (D) Aluminium oxide
3. Which of the following compounds does give N_2 on heating ?
(A) NH_4NO_2 (B) NH_4NO_3 (C) NaN_3 (D) Both (A) and (C)
4. Which of the following cannot result in the formation of NO ?
(A) $\text{N}_2 + \text{O}_2$ (Electric arc) (B) $\text{NH}_3 + \text{O}_2$; (Pt / Rh catalyst / 1200 K)
(C) $\text{NaNO}_3 / \text{HCl}$ (D) None of these
5. A substance dissolves in water giving a pale blue solution which decolourises KMnO_4 and oxidises KI to I_2 in acidic medium :
(A) N_2O_5 (B) NH_3 (C) N_2O_3 (D) HNO_3
6. Which of the following will not decolourise acidified KMnO_4 ?
(A) $\text{S}_2\text{O}_4^{2-}$ (B) $\text{S}_2\text{O}_5^{2-}$ (C) $\text{S}_2\text{O}_3^{2-}$ (D) $\text{S}_2\text{O}_7^{2-}$
7. Which of the following statements is not true about ozone ?
(A) It is a pale blue gas at room temperature.
(B) It oxidises sulphur and phosphorus evolving oxygen gas.
(C) It is odourless.
(D) It turns dry KOH red.
8. Sulphuric acid reacts with PCl_5 to give
(A) Thionyl chloride (B) Sulphur monochloride
(C) Sulphuryl chloride (D) Sulphur tetrachloride

Section-2 : (One or More than one options correct Type)

This section contains 6 multiple choice questions. Each questions has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

9. Which is greater for P_4 (white) than P_4 (red) -
(A) Molar entropy (B) Melting point
(C) Solubility in CS_2 (D) Ignition temperature



10. What is/are not true about phosphine (PH_3) ?
 (A) It turns red litmus blue.
 (B) It reacts with HCl (aq.) to give PH_4Cl .
 (C) Phosphonium compounds are obtained when anhydrous phosphine reacts with anhydrous HBr or HI .
 (D) It is prepared by hydrolysis of metal phosphides with acids.
11. Which of the following is/are correct regarding nitrogen family.
 (A) Nitrogen is restricted to a maximum covalency of 4 as only four orbitals are available for bonding.
 (B) The single N-N bond is weaker than the single P-P bond.
 (C) The catenation tendency is weaker in nitrogen as compared to phosphorous.
 (D) Nitrogen forms $p\pi-p\pi$ bond as well as $p\pi-d\pi$ bonds.
12. P_2O_5 can dehydrate.
 (A) H_2SO_4 (B) HNO_3 (C) HClO_4 (D) HPO_3
13. The products formed when H_3PO_2 is heated at 415 K and at 435 K are :
 (A) H_3PO_3 (B) H_3PO_4 (C) HPO_3 (D) PH_3
14. $4\text{AgNO}_3 + 2\text{H}_2\text{O} + \text{H}_3\text{PO}_2 \xrightarrow{\text{boil}} 4\text{Ag} + \text{'X'} + \text{'Y'}$
 If X is oxyacid of nitrogen and Y is oxyacid of phosphorous then correct statement(s) is/are :
 (A) X is HNO_2
 (B) Y is H_3PO_4
 (C) H_3PO_2 act as good reducing agent
 (D) The oxidation number of 'P' changed from +1 to +5

Section-3 : (Numerical Value Type.)

This section contains 6 questions. Each question, when worked out will result in numerical value from 0 to 9 (both inclusive).

15. Cold dilute nitric acid would dissolve how many of the following without significant evolution of any gas :
 Pb , Mg , Sb , Au , Ag , Fe , Mn , Sn , P_4
16. Which of the following on heating will produce an oxide of nitrogen.
 $(\text{NH}_4)_2\text{SO}_4$, $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$, NH_4NO_3 , KNO_3 , $\text{Pb}(\text{NO}_3)_2$, $(\text{NH}_4)_2\text{HPO}_4$, NH_4Cl , NH_4NO_2
17. NaPO_3 can significantly react with how many of the following ?
 CaCl_2 , MgSO_4 , CaO , Na_2CO_3 , dry HCl , $\text{Ca}(\text{HCO}_3)_2$, Na_3PO_4
18. One mole of PCl_3 is dissolved in excess of water. No. of moles of NaOH required to neutralise this solution completely is :
19. When hypo solution react with CuCl_2 and produce soluble complex, then how many no. of moles of atoms present in one mole of soluble complex in co-ordination sphere.
20. How many of the following reactions yield POCl_3 ?
 (i) $\text{PCl}_3 + \text{O}_2 \longrightarrow$ (ii) $\text{PCl}_5 + \text{CO}_2 \longrightarrow$ (iii) $\text{PCl}_5 + \text{CH}_3\text{COOH} \longrightarrow$
 (iv) $\text{PCl}_5 + \text{H}_3\text{BO}_3 \longrightarrow$ (v) $\text{PCl}_3 + \text{SO}_2\text{Cl}_2 \longrightarrow$ (vi) $\text{P}_4\text{O}_{10} + \text{NaCl} \longrightarrow$
 (vii) $\text{PCl}_5 + \text{H}_2\text{O} \longrightarrow$ (viii) $\text{PCl}_5 + \text{SO}_2 \longrightarrow$ (ix) $\text{PCl}_3 + \text{SO}_3 \longrightarrow$

SECTION-4 : Comprehension Type (Only One options correct)

This section contains 1 paragraphs, each describing theory, experiments, data etc. 2 questions relate to the paragraph. Each question has only one correct answer among the four given options (A), (B), (C) and (D).

Paragraph for Questions 21 to 22

An orange solid (A) on heating gives a green residue (B), a colourless gas (C) and water vapours. The dry gas (C) on passing over heated Mg gave a white solid (D). (D) on reaction with water gave a gas (E) which formed black precipitate with mercurous nitrate solution.



21. Select the incorrect statement.
 (A) The central atom (s) of the anion of solid (A) has sp^3 hybridisation.
 (B) The orange solid (A) is diamagnetic in nature.
 (C) The anion of orange solid (A) is oxidising in nature.
 (D) All metal oxygen bond lengths are equal in anion of solid (A).
22. Which of the following is false for the gas (E) ?
 (A) It gives a deep blue colouration with $CuSO_4$ solution.
 (B) It is oxidised to a colourless gas (neutral oxide) at 1200 K in presence of a catalyst Pt/Rh in air.
 (C) It gives the same gas (C) with potassium permanganate solution.
 (D) It gives black precipitate with $HgCl_2$.

SECTION-5 : Matching List Type (Only One options correct)

This section contains 1 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (A), (B), (C) and (D) out of which one is correct

23. Match the reactions listed in column-I with characteristic(s) listed in column-II.

	Column-I		Column-II
(1)	$2NO_2 \xrightarrow{\text{Cool}}$	(p)	One of the products is a mixed anhydride.
(2)	$ClO_2 + O_3 \xrightarrow{H^+}$	(q)	One of the products is an acidic oxide.
(3)	$K_4[Fe(CN)_6] + H_2SO_4 (\text{conc.}) + H_2O \xrightarrow{\Delta}$	(r)	The oxidation state of the central atom of one of the products is +6.
(4)	$KOH + O_3 \longrightarrow$	(s)	One of the products is a colourless paramagnetic gas.

(A) 1 - p, q ; 2 - p, q, s ; 3 - r ; 4 - s

(B) 1 - p, q ; 2 - p, q, r, s ; 3 - r ; 4 - s

(C) 1 - p ; 2 - p, q, r, s ; 3 - r ; 4 - s

(D) 1 - p, q ; 2 - q, r, s ; 3 - s ; 4 - r

Practice Test-2 (IIT-JEE (ADVANCED 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							
Ans.										



APSP Answers

PART - I

1.	(1)	2.	(3)	3.	(3)	4.	(1)	5.	(3)
6.	(3)	7.	(3)	8.	(1)	9.	(3)	10.	(2)
11.	(2)	12.	(2)	13.	(2)	14.	(3)	15.	(3)
16.	(4)	17.	(2)	18.	(3)	19.	(2)	20.	(2)
21.	4.5	22.	8	23.	6	24.	3	25.	2

PART - II

1.	(1)	2.	(2)	3.	(1)	4.	(2)	5.*	(1, 4)
6.	(4)	7.	All statement are correct there is no answer					8.	(1)
9.	(1)	10.	(1)	11.	(4)	12.	(4)	13.	(1)
14.	(2)								

PART - III

1.	(C)	2.	(A)	3.	(B)	4.	(A)	5.	(D)
6.	(B)	7.	(D)	8.	(B)	9.	(A)	10.	(A)
11.	(D)	12.	(B)	13.	(D)	14.	(A)	15.	(B)
16.	(D)	17.	(C)	18.	(B)	19.	(C)	20.	(A)
21.	(A)	22.	(A)	23.	(B)	24.	(B)	25.	(B)
26.	(A)	27.	(D)	28.	(C)	29.	(A)		

PART - IV

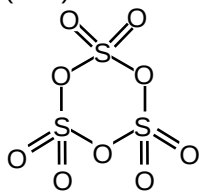
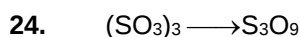
1.	(C)	2.	(B)	3.	(D)	4.	(C)	5.	(C)
6.	(D)	7.	(C)	8.	(C)	9.	(AC)	10.	(AB)
11.	(ABCD)	12.	(ABC)	13.	(ABD)	14.	(BCD)	15.	4
16.	2	17.	6	18.	5	19.	31	20.	7
21.	(D)	22.	(D)	23.	(B)				



APSP Solutions

PART - I

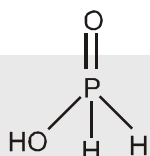
- Poor shielding by f- and d-electrons enhances the effective nuclear charge in Bi. This causes contraction in size.
- (1) $(\text{NH}_4)\text{NO}_3$ gives N_2O , (2) chlorine (excess) with liquor NH_3 forms NCl_3 and (4) $\text{Pb}(\text{NO}_3)_2$ gives NO_2 not N_2 on heating.
(3) 5Cu (red hot) + $2\text{HNO}_3 \longrightarrow 5\text{CuO} + \text{N}_2 \uparrow + \text{H}_2\text{O}$
- $2\text{Ca}_3(\text{PO}_4)_2$ (from bone-ash) + $10\text{C} + 6\text{SiO}_2 \xrightarrow{\Delta} 6\text{CaSiO}_3 + 10\text{CO} + \text{P}_4(\text{s})$ white phosphorus
- Factual
- $3\text{O}_2 \xrightleftharpoons[\text{discharge}]{\text{electric}} 2\text{O}_3$
- Both rhombic & monoclinic sulphur has crown shape.
- Tailing of mercury.
- The order of boiling point of hydride of oxygen family is $\text{H}_2\text{O} > \text{H}_2\text{Te} > \text{H}_2\text{Se} > \text{H}_2\text{S}$.
- The oxidation state of copper changes from +2 to 0 i.e. it gets reduced. So, NH_3 works as a reducing agent.
- $\text{P}_4 + 3\text{NaOH} + 3\text{H}_2\text{O} \xrightarrow{\Delta} \text{PH}_3 + 3\text{NaH}_2\text{PO}_2$
- $\text{NH}_4\text{NO}_3 \xrightarrow{\Delta} \text{N}_2\text{O} + 2\text{H}_2\text{O}$
- $\text{Fe}^{2+} + \text{NO} + 5\text{H}_2\text{O} \longrightarrow [\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$ (brown complex).
- CHCl_3 (chloroform) react with conc. HNO_3 on heating to form chloropicrin (CCl_3NO_2)
 $\text{CHCl}_3 + \text{HONO}_2 \longrightarrow \text{CCl}_3\text{NO}_2 + \text{H}_2\text{O}$
Chloropicrin
Chloropicrin is used as an insecticide and also war gas. It is also known as nitrochloroform or tear gas.
- $2\text{H}_2\text{SO}_4 + \text{P}_2\text{O}_5$ (dehydrating agent) $\longrightarrow 2\text{SO}_3 + 2\text{HPO}_3 + \text{H}_2\text{O}$
- $\text{H}_3\text{PO}_4 \xrightarrow{220^\circ\text{C}} \text{H}_4\text{P}_2\text{O}_7 \xrightarrow{320^\circ\text{C}} (\text{HPO}_3)_n$.
- (1) $\text{Ba}(\text{NO}_3)_2 + \text{H}_2\text{SO}_4 \longrightarrow 2\text{HNO}_2 + \text{BaSO}_4 \downarrow$
(2) It is an unstable, weak acid which is known only in aqueous solution.
(3) $2\text{HNO}_2 \longrightarrow \text{N}_2\text{O}_3 + \text{H}_2\text{O}$
- $\text{H}_2\text{O} + \text{OF}_2 \xrightarrow{\text{very slowly}} 2\text{HF} + \text{O}_2$ (OF_2 is neutral towards litmus)
- Factual
- $3\text{S} + 6\text{NaOH} \longrightarrow 3\text{H}_2\text{O} + 2\text{Na}_2\text{S} + \text{Na}_2\text{SO}_3$
- $\text{Na}_2\text{SO}_3 + \text{S} \xrightarrow[\text{OH}^-]{\text{Boiling}} \text{Na}_2\text{S}_2\text{O}_3$
- $2\text{I}_2 + 5\text{O}_3 \longrightarrow \text{I}_4\text{O}_9 + 3\text{O}_2$
Oxidation state of iodine in $\text{I}_4\text{O}_9 \longrightarrow 4x - 9 \times 2 = 0$
 $x = 4.5$ Ans
- $\text{Cu}^{2+} + \text{PH}_3 + 4\text{H}_2\text{O} \longrightarrow \text{H}_3\text{PO}_4 + \text{Cu} + 8\text{H}^+$



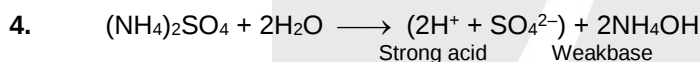
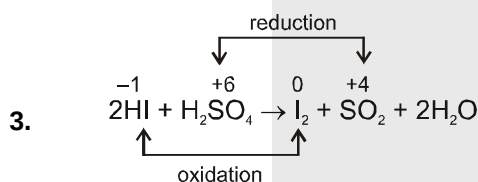
PART - II

1. The spontaneous combustion of phosphine is technically used in Holme's signals. Containers containing calcium carbide and calcium phosphide are pierced and thrown in the sea when the gases evolved burn and serve as a signal.

2. Hypophosphorus acid



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



$(\text{NH}_4)_2\text{SO}_4$ on hydrolysis produces strong acid H_2SO_4 , which increases the acidity of the soil.

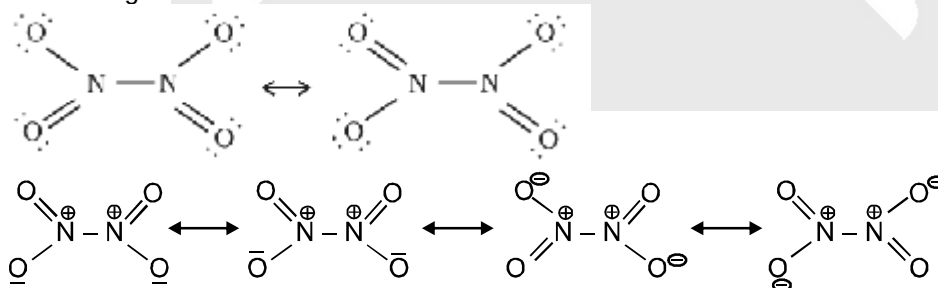
- 5.* The stability of hydrides decreases from NH_3 to BiH_3 which can be observed from their bond dissociation enthalpy. The correct order is $\text{NH}_3 < \text{PH}_3 < \text{AsH}_3 < \text{SbH}_3 < \text{BiH}_3$.

Property	NH_3	PH_3	AsH_3	SbH_3	BiH_3
$\Delta_{\text{diss}}H^\ominus(\text{E-H}) / \text{kJ mol}^{-1}$	389	322	297	255	—

Alternate Solution

N_2O_4 may have four resonating structures but in NCERT only two resonating structures.

Resonating structures of N_2O_4 are



6. Sulphur exhibits +2, +4, +6 oxidation states but +4 and +6 are more common.

7. (1) $\text{ONCl} = 8 + 7 + 17 = 32e^-$
 $\text{ONO}^- = 8 + 7 + 8 + 1 = 24e^-$ (correct)

- (2) Central atom O is sp^2 hybridised with 1 lone pair, so bent shape (correct)
- (3) Ozone is violet-black in solid state. (Ref. NCERT & Shriver Atkins)
- (4) O_3 has no unpaired electrons, so diamagnetic (correct)



8. NO is paramagnetic in gaseous state.
9. 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.
11. Orthophosphorous acid $\left(\text{H}_3\text{P}^{\text{+3}}\text{O}_3 \right)$; Pyrophosphorous acid $\left(\text{H}_2\text{P}_2^{\text{+3}}\text{O}_5 \right)$
12. $\text{Zn} + \text{HNO}_3 \text{ (dil.)} \longrightarrow \text{Zn}(\text{NO}_3)_2 \text{ (aq)} + \text{N}_2\text{O} + \text{H}_2\text{O}$
 $\text{Zn} + \text{HNO}_3 \text{ (conc.)} \longrightarrow \text{Zn}(\text{NO}_3)_2 + \text{NO}_2 + \text{H}_2\text{O}$
13. $2[\text{Fe}(\text{CN})_6]^{4-} + \text{H}_2\text{O}_2 + 2\text{H}^+ \longrightarrow 2[\text{Fe}(\text{CN})_6]^{3-} + 2\text{H}_2\text{O}$
 $2[\text{Fe}(\text{CN})_6]^{3-} + \text{H}_2\text{O}_2 + 2\text{OH}^- \longrightarrow 2[\text{Fe}(\text{CN})_6]^{4-} + \text{O}_2 + 2\text{H}_2\text{O}$
14. (1) $\text{NH}_4\text{NO}_2 \xrightarrow{\Delta} \text{N}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{l})}$
 (2) $(\text{NH}_4)_2\text{SO}_4 \xrightarrow{\Delta} 2\text{NH}_{3(\text{g})} + \text{H}_2\text{SO}_4$
 (3) $\text{Ba}(\text{N}_3)_2 \xrightarrow{\Delta} \text{Ba}(\text{s}) + 3\text{N}_{2(\text{g})} \text{ (Pure)}$
 (4) $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \xrightarrow{\Delta} \text{N}_{2(\text{g})} + \text{Cr}_2\text{O}_{3(\text{s})} + 4\text{H}_2\text{O}_{(\text{l})}$

PART - IV

2. $2\text{HgO} \xrightarrow{450^\circ\text{C}} 2\text{Hg} + \text{O}_2$
3. (A) $\text{NH}_4\text{NO}_2 \xrightarrow{\Delta} \text{N}_2 + 2\text{H}_2\text{O}$, (B) $\text{NH}_4\text{NO}_3 \xrightarrow{\Delta} \text{N}_2\text{O} + 2\text{H}_2\text{O}$, (C) $2\text{NaN}_3 \xrightarrow{\Delta} 3\text{N}_2 + 2\text{Na}$.
4. The reaction of NaNO_3 and HCl do not give NO.
 $\text{NaNO}_3 + \text{HCl} \longrightarrow \text{NaCl} + \text{HNO}_3$; $4\text{HNO}_3 \longrightarrow \text{H}_2\text{O} + \text{NO}_2 + \text{O}_2$
5. $\text{N}_2\text{O}_3 + \text{H}_2\text{O} \longrightarrow \text{HNO}_2$;
 $2\text{KMnO}_4 + 5\text{KNO}_2 + 6\text{HCl} \longrightarrow 2\text{MnCl}_2 + 5\text{KNO}_3 + 3\text{H}_2\text{O} + 2\text{KCl}$
 $2\text{KI} + 2\text{HNO}_2 + 2\text{HCl} \longrightarrow 2\text{H}_2\text{O} + 2\text{NO} + 3\text{KCl} + \text{I}_2$
6. (A), (B) and (C) are reducing agents while (D) is not.
8. $2\text{PCl}_5 + \text{H}_2\text{SO}_4 \longrightarrow \text{SO}_2\text{Cl}_2 + 2\text{POCl}_3 + 2\text{HCl}$
9. Factual
10. (A) PH_3 is a lewis base but is neutral towards red litmus.
 (B) It does not react with $\text{HCl}(\text{aq})$ or $\text{HI}(\text{aq})$. This is because water decomposes PH_4X formed to give back PH_3 .
 (C) It reacts only with anhydrous HI or HBr .
 (D) $2\text{Na}_3\text{P} + 3\text{H}_2\text{SO}_4 \longrightarrow 3\text{Na}_2\text{SO}_4 + 2\text{PH}_3 \uparrow$; $\text{Ca}_3\text{P}_2 + 6\text{HCl} \longrightarrow 3\text{CaCl}_2 + 2\text{PH}_3$
11. Nitrogen can not form $p\pi-d\pi$ bond because nitrogen has no d-orbitals.
12. P_2O_5 reacts with H_2SO_4 , HNO_3 , HClO_4 .
13. At 415 K ; $3\text{H}_3\text{PO}_2 \longrightarrow 2\text{H}_3\text{PO}_3 + \text{PH}_3 \uparrow$
14. $4\text{AgNO}_3 + 2\text{H}_2\text{O} + \text{H}_3\text{PO}_2 \longrightarrow 4\text{Ag} + 4\text{HNO}_3 \text{ (X)} + \text{H}_3\text{PO}_4 \text{ (Y)}$
15. NO is evolved with Pb, Sb, Ag, P_4 .
 NH_4NO_3 is formed and no gas is evolved with Mg, Fe, Mn, Sn.
 No reaction with Au.
16. $\text{NH}_4\text{NO}_3 \xrightarrow{\Delta} \text{N}_2\text{O} + 2\text{H}_2\text{O}$
 $\text{Pb}(\text{NO}_3)_2 \xrightarrow{\Delta} \text{PbO} + \text{NO}_2 + \text{O}_2$
17. $\text{CaCl}_2 + \text{NaPO}_3 \longrightarrow$ Forms chelate complex with Ca^{2+} , $[\text{Ca}(\text{P}_3\text{O}_9)_2]^{4-}$, used in softening of hard water.



$\text{MgSO}_4 + \text{NaPO}_3 \longrightarrow$ Forms chelate complex with Mg^{2+} , $[\text{Mg}(\text{P}_3\text{O}_9)_2]^{4-}$, used in softening of hard water.

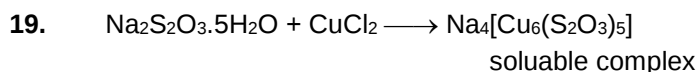
$\text{CaO} + \text{NaPO}_3 \longrightarrow \text{NaCaPO}_4$

$\text{Na}_2\text{CO}_3 + \text{NaPO}_3 \longrightarrow \text{Na}_3\text{PO}_4 + \text{CO}_2$

dry $\text{HCl} + \text{NaPO}_3 \longrightarrow$ No reaction

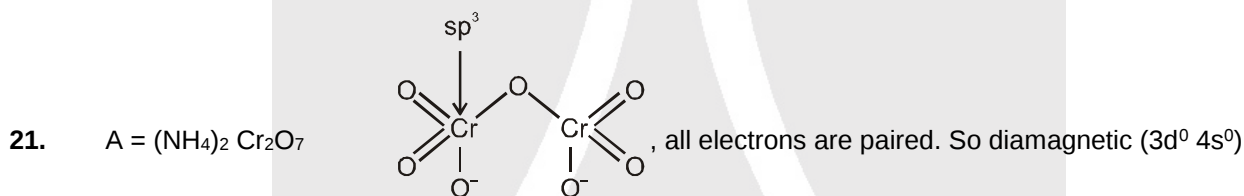
$\text{Ca}(\text{HCO}_3)_2 + \text{NaPO}_3 \longrightarrow$ Forms chelate complex with Ca^{2+} , $[\text{Ca}(\text{P}_3\text{O}_9)_2]^{4-}$ used in softening of hard water.

$\text{Na}_3\text{PO}_4 + \text{NaPO}_3 \longrightarrow \text{Na}_4\text{P}_2\text{O}_7$



Number of atom in Co-ordination sphere = $6 + 2 \times 5 + 3 \times 5 = 6 + 10 + 15 = 6 + 25 = 31$ Ans.

20. (i) $\text{PCl}_3 + \text{O}_2 \longrightarrow \text{POCl}_3$ (ii) $\text{PCl}_5 + \text{CO}_2 \longrightarrow$ No reaction
(iii) $\text{PCl}_5 + \text{CH}_3\text{COOH} \longrightarrow \text{CH}_3\text{COCl} + \text{POCl}_3 + \text{HCl}$ (iv) $\text{PCl}_5 + \text{H}_3\text{BO}_3 \longrightarrow \text{POCl}_3 + \text{B}_2\text{O}_3$
(v) $\text{PCl}_3 + \text{SO}_2\text{Cl}_2 \longrightarrow \text{PCl}_5 + \text{SO}_2$ (vi) $\text{P}_4\text{O}_{10} + \text{NaCl} \longrightarrow \text{POCl}_3 + \text{NaPO}_3$
(vii) $\text{PCl}_5 + \text{H}_2\text{O} \longrightarrow \text{POCl}_3 + 2\text{HCl}$ (viii) $\text{PCl}_5 + \text{SO}_2 \longrightarrow \text{SOCl}_2 + \text{POCl}_3$
(ix) $\text{PCl}_3 + \text{SO}_3 \longrightarrow \text{POCl}_3 + \text{SO}_2$



$\text{Cr}_2\text{O}_7^{2-}$ acts as strong oxidising agent in acidic medium.

22. (E) = NH_3
(A) $\text{Cu}^{2+} + 4\text{NH}_3 \longrightarrow [\text{Cu}(\text{NH}_3)_4]^{2+}$ (deep blue colouration).
(D) $\text{HgCl}_2 + \text{NH}_3 + \text{H}_2\text{O} \longrightarrow \text{HgO} \cdot \text{Hg}(\text{NH}_2)\text{Cl} \downarrow$ (white)

23. (1) $2\text{NO}_2 \xrightarrow{\text{Cool}} \text{N}_2\text{O}_4$ colourless solid / liquid, acidic, mixed anhydride of HNO_2 and HNO_3
(2) $2\text{ClO}_2 + 2\text{O}_3 \xrightarrow{\text{H}^+} \text{Cl}_2\text{O}_6$ (yellow solid) + 2O_2 ; acidic, mixed anhydride of HClO_3 and HClO_4 .
(3) $\text{K}_4[\text{Fe}(\text{CN})_6] + 6\text{H}_2\text{O} + 6\text{H}_2\text{SO}_4 \xrightarrow{\Delta} 2\text{K}_2\text{SO}_4 + \text{FeSO}_4 + 3(\text{NH}_4)_2\text{SO}_4 + 6\text{CO} \uparrow$
(4) $2\text{KOH} + 5\text{O}_3 \longrightarrow 2\text{KO}_3$ (orange solid) + $5\text{O}_2 + \text{H}_2\text{O}$