One Two academy | p-Block Elements - II

Maximum Mark: 25 **Chemistry** **Time: 50 minutes**

Choose the correct answer: **3 x 1 = 3**

1. Among the following the correct order of acidity is
   a) $HClO_2 < HClO < HClO_3 < HClO_4$ b) $HClO_4 < HClO_2 < HClO < HClO_3$
   c) $HClO_3 < HClO_4 < HClO_2 < HClO$ d) $HClO < HClO_2 < HClO_3 < HClO_4$
2. _____ is used for producing smoke screen as it gives large smoke.
   a) Borax b) Diborane c) Potash Alum b) Phosphine
3. Which of the following is used as the source of gamma rays?
   a) Xe b) Ar c) Rn d) Kr

Answer Any four of the following: **4 x 2 = 8**

4. What is inert pair effect?
5. How will you prepare chlorine in the laboratory?
6. Ozone acts as a powerful oxidizing agent why?
7. Write about the uses of Phosphine.
8. Write about the preparation of Nitrogen.

Answer any three of the following: **3 x 3 = 9**

9. Explain the test for sulphate/sulphuric acid.
10. What are interhalogen compounds? Give examples.
11. Complete the following reactions.
    a) $NaCl + MnO_2 + H_2SO_4 \rightarrow$
    b) $XeO_6^{4-} + Mn^{2+} + H^+ \rightarrow$
    c) $Cu + H_2SO_4$ (Hot conc.) $\rightarrow$
12. Explain the structure of ammonia

Answer the following: **1 x 5 = 5**

13. a) Explain the manufacture of sulphuric acid by contact process

(Or)

b) i) Write the reason for the anomalous behavior of Nitrogen.
   ii) Explain Deacon's Process.

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All the Best

Answer Key attached in the next page !!!

This page is to prevent seeing answer key

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Answer Key

Choose the Correct answer:

1. - d) 2. - d) 3. - c)

Answer any four of the following:

4. **Inert pair effect:** In heavier post transition metals, the outer s electrons (ns) have a tendency to remain inert and show reluctance to take part in the bonding, which is known as inert pair effect. This effect is also observed in groups 14, 15 and 16.

5. **Laboratory preparation of chlorine:**

Chlorine is prepared by oxidizing hydrochloric acid using potassium permanganate.

$$2KMnO_4 + 16HCl \rightarrow 2KCl + 2MnCl_2 + 8H_2O + 5Cl_2$$

6. **Ozone as a powerful oxidizing agent: o**zone is a powerful oxidising agent, and it reacts with many substances under conditions where oxygen will not react. For example, it oxidises potassium iodide to iodine. This reaction is quantitative and can be used for estimation of ozone.

$$O_3 + 2KI + H_2O \rightarrow + 2KOH + O_2 + I_2$$

7. **Uses of Phosphine:**

Phosphine is used for producing smoke screen as it gives large smoke. In a ship, a pierced container with a mixture of calcium carbide and calcium phosphide, liberates phosphine and acetylene when thrown into sea. The liberated phosphine catches fire and ignites acetylene. These burning gases serves as a signal to the approaching ships. This is known as Holmes signal.

8. **Preparation of Nitrogen:** Nitrogen, the principal gas of atmosphere (78 % by volume) is separated industrially from liquid air by fractional distillation. Pure nitrogen gas can be obtained by the thermal decomposition of sodium azide about 575 K

$$2NaN_3 \rightarrow 2\,Na + 3N_2$$

Answer any three of the following:

9. **Test for sulphate/sulphuric acid:** Dilute solution of sulphuric acid/aqueous solution of sulphates gives white precipitate (barium sulphate) with barium chloride solution. It can also be detected using lead acetate solution. Here a white precipitate of lead sulphate is obtained.

$$BaCl2 + H2\,SO4 \rightarrow BaSO4\downarrow + 2HCl$$

Barium sulphate
(White precipitate)

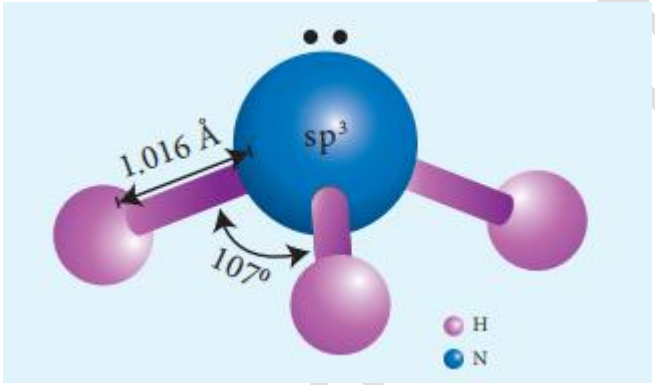
$$(CH_3\,COO)_2\,Pb + H_2\,SO_4 \rightarrow PbSO_4\downarrow + 2CH_3\,COOH$$

LeadSulphate

(White precipitate)

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10. **Interhalogen Compounds:** Each halogen combines with other halogens to form a series of compounds called inter halogen compounds.
    i. The central atom will be the larger one
    ii. It can be formed only between two halogen and not more than two halogens.
    Eg: ClF, BrF, IF_7
11. a) $4NaCl + MnO_2 + 4H_2SO_4 \rightarrow Cl_2 + MnCl_2 + 4NaHSO_4 + 2H_2O$
    b) $5XeO^{4-}_6 + 2Mn^{2+} + 14H^+ \rightarrow 2MnO^-_4 + 5XeO_3 + 7H_2O$
    c) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + 2H_2O + SO_2\uparrow$
12. **Structure of ammonia:**
    Ammonia molecule is pyramidal in shape N-H bond distance is 1.016 Å and H-H bond distance is 1.645 Å with a bond angle 107°. The structure of ammonia may be regarded as a tetrahedral with one lone pair of electrons in one tetrahedral position hence it has a pyramidal shape.



Answer the following:

13. a) **Manufacture of sulphuric acid by contact process:**
    The contact process involves the following steps.
    i. Initially sulphur dioxide is produced by burning sulphur or iron pyrites in oxygen/air.

$$S + O_2 \rightarrow SO_2$$

$$4FeS_2 + 11O_2 \rightarrow 2Fe_2O_3 + 8SO_2$$

    ii. Sulphur dioxide formed is oxidised to sulphur trioxide by air in the presence of a catalyst such as V_2O_5 or platinised asbestos.
    iii. The sulphur trioxide is absorbed in concentrated sulphuric acid and produces oleum ($H_2S_2O_7$). The oleum is converted into sulphuric acid by diluting it with water.

$$SO_3 + H_2SO_4 \rightarrow H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$$

    To maximize the yield the plant is operated at 2 bar pressure and 720 K. The sulphuric acid obtained in this process is over 96 % pure.

(Or)

    b) i) **Anomalous behavior of Nitrogen:**
    Nitrogen differs from the rest of the members of this group due to its small size high electronegativity, high ionization enthalpy and non-availability of d orbitals.

    ii) **Deacon's process:** In this process a mixture of air and hydrochloric acid is passed up a chamber containing a number of shelves, pumice stones soaked in cuprous

chloride are placed. Hot gases at about 723 K are passed through a jacket that surrounds the chamber.

$$4HCl + O_2 \xrightarrow[Cu_2Cl_2]{400^0C} 2H_2O + 2Cl_2 \uparrow$$

The chlorine obtained by this method is dilute and is employed for the manufacture of bleaching powder.

$$2Cu_2Cl_2 + O_2 \longrightarrow \underset{\text{Cuprous oxy chloride}}{2Cu_2OCl_2}$$

$$Cu_2OCl_2 + 2HCl \longrightarrow \underset{\text{Cupric chloride}}{2CuCl_2} + H_2O$$

$$2CuCl_2 \longrightarrow \underset{\text{Cuprous chloride}}{Cu_2Cl_2} + Cl_2$$

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