Class XII Chemistry

Practice Question Series

Inorganic Conceptual 1 : P Block Elements

CASE STUDY 1

Molecular Nitrogen N_2 comprises about 78% by volume of Earth's atmosphere. It occurs as Sodium nitrate, $NaNO_3$(chile saltpeter) & Potassium nitrate, KNO3(Indian saltpeter) in earth's crust. Since nitrate are very soluble in water so these are not wide spread in the earth's crust. Nitrogen is also an important constituent of amino acids, protein & nucleic acids in plants & animals.

Nitrogen shows anomalous behavior from rest of the elements due to following reasons;

Smaller size, high ionization enthalpy, high electronegativity & absence of d-orbital. It has unique ability to form pΠ-pΠ multiple bonds with itself & with small size atoms like C & O as they have small size & high electronegativity. Heavier elements of this group do not form pΠ-pΠ bonds as their atomic orbitals are so large & diffuse that they can't have effective overlapping.

Thus Nitrogen exists as diatomic molecules (N2) with a triple bond. Consequently, its bond enthalpy (941.4 KJ mol-1) is very high. P, As & Sb form only single bonds as P-P, As-As & Sb-Sb. Due to much bond enthalpy N is much less reactive than P.

Single N-N bond is weaker than single P-P bond due to high interelectronic repulsion of the non bonding electrons, owing to small bond length. As a result, the catenation tendency is weaker in nitrogen. Hence nitrogen exists as gas while phosphorus exists as solid.

Nitrogen can't form $d\pi - d\pi$ bond due to absence of d- orbitals so it can't expand its covalency beyond four as heavier members can.

The following questions are multiple choice questions. Choose the most appropriate answer.

1. Among group 15 elements which exists as gas at room temperature
   a) Arsenic b) Bismuth c) Nitrogen d) Phosphorous
2. The stability of +5 oxidation state decreases and that of +3 state increases down the group in group 15 elements due to
   a) Inert pair effect b) Decrease in ionisation enthalpy
   c) Increase in size d) Shielding effect
3. Nitrogen is restricted to a maximum covalency of 4 because of
   a) Absence of d-orbitals b) Presence of d-orbitals
   c) Absence of s and p-orbitals d) None of the above
4. Extra pure N_2 can be obtained by heating
   a) NH3 with CuO b) $NH4NO_3$ c) $(NH_4)_2Cr_2O_7$ d) $Ba(N_3)_2$
5. Catenation tendency is weaker in nitrogen, because of
   a) Single N–N bond is weaker b) Single N–N bond is stronger
   c) ability to form pi bonds by N atoms d) None of the above
6. The structure of PCl_5 in solid state
   a) Ionic solid, with $\left[PCl_4\right]^+$ tetrahedral and $\left[PCl_6\right]^-$ octahedral
   b) Ionic solid, with $\left[PCl_4\right]^+$ octahedral and $\left[PCl_6\right]^-$ tetrahedral
   c) Ionic solid, with $\left[PCl_4\right]^-$ tetrahedral and $\left[PCl_6\right]^+$ octahedral
   d) None of these
7. In the preparation of H_2SO_4 by Contact Process, why is SO_3 not absorbed directly in water to form H_2SO_4?
   a) It is difficult to absorb
   b) It can cause local heating and burning
   c) Acid fog is formed, which is difficult to condense
   d) None of these

8. There is a considerable increase in covalent radius from N to P. However, from As to Bi only a small increase in covalent radius is observed. This is due to
   a) Increase in number of shells
   b) Increase in valence electrons
   c) increase in ionisation enthalpy
   d) The presence of completely filled d and/or f orbitals
9. The ionisation enthalpy of the group 15 elements is much greater than that of group 14 elements in the corresponding periods. Which is the most suitable reason?
   a) More effective nuclear charge
   b) Presence of stable half-filled electronic configuration
   c) Smaller size
   d) High electronegativity
10. Which one is not correct statement?
   a) Nitrogen does not form pentahalide due to non-availability of the d orbitals in its valence shell
   b) Pentahalides are more covalent than trihalides.
   c) In case of nitrogen, only NF3 is known to be stable
   d) Trihalides except BiF3 are predominantly ionic in nature

CASE STUDY 2

Group 16 elements are called chalcogens i.e., ore forming elements (oxygen, sulphur, selenium etc.) because most of the ores are oxides and sulphides. Oxygen is gas where as other elements of group 16 are solids. Oxygen shows anomalous behaviour. Oxygen is diatomic where is sulphur exists as S8 which has crown shaped structure. It shows allotropy. Sulphur is present in onion and garlic that is why they have pungent smell. Sulphur is used for manufacture of sulphuric acid which is called 'King of chemicals', used in fertilizer, detergents, dyes and drugs.

The following questions are multiple choice questions. Choose the most appropriate answer.

11. Group 16 elements are also known as
    a) Noble elements
    b) Halogens
    c) Pnictogens
    d) Chalcogens
12. Acidic character of hydrides of group 16 elements is in the order
    a) H2O < H2S < H2Se < H2Te
    b) H2S < H2Se < H2Te<H2O
    c) H2O < H2Se < H2Te < H2S
    d) H2O < H2S < H2Te < H2Se
13. Hybridisation of S in SF4 and geometry of SF4 are respectively
    a) sp^3d, trigonal pyramidal
    b) sp^3d, see saw
    C) SP^3, TETRAHEDRAL
    D) DSP^2, SQUARE PLANNER
14. Which is not an acidic oxide?
    a) CO_2 b) SO_2 c) Na_2O d) Cl_2O_7
15. Which is not correct about allotropes of sulphur
    a) The stable form at room temperature is rhombic sulphur
    b) Monoclinic sulphur is stable above 369 K and transforms into rhombic sulphur below it
    c) At 369 K both the forms are stable
    d) Monoclinic sulphur is soluble in CS2 while rhombic sulphur not

CASE STUDY 3

Group 18 elements are called noble gases and not inert gases because compounds of Kr, Xe and Rn have been prepared. Their general electronic configuration is ns2 np6 except He(1s 2). They have highest ionisation enthalpy and positive electron gain enthalpy due to stable electronic configuration. Helium is found in sun and stars. Noble gases have low boiling points due to weak van der Waals' forces of attraction. Xenon forms XeF2, XeF_4, XeF_6, $XeOF_4$, XeO_3, XeO_2F_2, their structures can be drawn on bases of VSEPR theory. Helium is mixed with oxygen by deep sea divers to avoid pain. Neon is used in coloured advertising lights. Argon is used in bulbs as inert gas.

Kr and Xe are used in high efficiency lamps, head light of cars. Radon is radioactive formed by a-decay of Radium 226 88Ra Argon is most abundant (0.9%) noble gas in atmosphere.

16. What are the elements in group 18 (the far right) of the periodic table called?
    a) Alkali metals b) Alkaline earth metals c) Halogens d) Noble gases
17. Out of (i) XeO3 (ii) XeOF4 and (iii) XeF6 , the molecules having the same number of lone pairs on Xe are –
    a) (i) and (ii) only b) (i) and (iii) only
    c) (ii) and (iii) only d) (i) , (ii) and (iii)
18. Which one has linear shape?
    a) XeF_2 b) XeF_4 c) XeF_6 d) XeO_3
19. Which of the outer electronic configuration represent Argon?
    a) ns^2np^4 b) ns^2np^3 c) ns^2np^6 d) ns^1np^6
20. Which of the following statement is false?
    a) Radon is obtained from the decay of radium b) Helium is an inert gas
    c) Xenon is the most reactive among the rare gases
    d) The most abundant rare gas found in the atmosphere is helium
21. PH_3 forms bubbles when passed slowly in water but NH_3 dissolves. Explain why?
    a) Ability of NH_3 to form hydrogen bond with water
    b) Ability of P in PH_3 to expand its octet
    c) Restricted covalency of Nitrogen d) Expanded Covalency of P
22. On a large-scale nitric acid is prepared mainly by
    a) Haber's process b) Ostwald's process
    c) Contact Process d) Deacon's process
23. Brown Ring Test is used to identify the
    a) Chloride ion b) Nitrite ion c) Nitride ion d) Nitrate ion
24. Which is incorrect statement.

a) Oxygen is the most abundant of all the elements on earth

b) Organic materials such as eggs, proteins, garlic, onion, mustard, hair and wool contain sulphur

c) Selenium and tellurium are found as metal selenides and tellurides in sulphide ores

d) Livermorium is a natural radioactive element

25. Which is the correct statement?

a) Valence shell electronic configuration of group 16 elements is ns1np4

b) The elements of group 16 have lower ionisation enthalpy values compared to those of Group15 in the corresponding periods

c) Oxygen atom has more negative electron gain enthalpy than sulphur

d) oxygen has the highest electronegativity value amongst the elements