

Important Questions on Inorganic Chemistry- Part III



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- Statement: Ore of aluminum is alumina (Al_2O_3) which has oxygen and not sulfur bonded to aluminum. What is the possible reason for above statement?
A. Al^{3+} is hard acid and O^{2-} is hard base.
B. Al^{3+} is soft acid and O^{2-} is hard base.
C. Al^{3+} is hard acid and O^{2-} is soft base.
D. Al^{3+} is soft acid and O^{2-} is soft base.
- How many molybdenum atom/atoms is/are present in Xanthine oxidase enzyme?
A. 1
B. 2
C. 3
D. 4
- How many molecular orbitals can be constructed from the valence shell orbitals of the constituent atoms in CH_4 ?
A. 3
B. 6
C. 4
D. 8
- Using the periodic table only, rank the elements in each of the following correct sets in order of decreasing IE_1 .
A. $\text{Kr} > \text{He} > \text{Ar}$
B. $\text{Sb} < \text{Te} < \text{Sn}$
C. $\text{Ca} > \text{K} > \text{Rb}$
D. $\text{I} < \text{Xe} > \text{Cs}$
- The light pink colour of $[\text{Co}(\text{NH}_3)_6]^{+2}$ and dark blue colour of $[\text{Co}(\text{OH})_6]^{-4}$ is due to :
A. MLCT transition in first and d-d transition in second.
B. MLCT transition in both.
C. d-d Transition in both.
D. d-d transition in first and LMCT in second.
- Which of the following Ligands will form a stable complex with Ln^{3+} ion?
A. H_2O
B. CO
C. C_2H_4
D. PPh_3
- What will be the total numbers of fine and hyperfine EPR lines for octahedral high-spin Mn (II) complexes respectively ($I = 5/2$ for Mn)?
A. 5 and 30
B. 5 and 33
C. 3 and 30
D. 3 and 33
- In equimolar ratio at 120-150°C with the help of appropriate solvents, triphosphazene is prepared by reacting X and Y. Identify reactants X and Y, respectively.
A. PCl_5 ; NH_3
B. PCl_3 ; NH_3
C. PCl_3 ; NH_4Cl
D. PCl_5 ; NH_4Cl
- Hapticity of S in Fe_3S_4 is:
A. 1
B. 2
C. 3
D. 4
- The main ingredient of gunpowder:
A. Cu, Sn and Zn
B. Cu and Fe
C. Mn and Tc
D. Zn and Cd

Answer Key

- | | | | | | | |
|------|------|-------|------|------|------|------|
| 1. A | 2. B | 3. D | 4. C | 5. C | 6. A | 7. A |
| 8. D | 9. A | 10. A | | | | |

Solutions

Solution 1.

HSAB principle: According to this principle, Hard acid tends to react with hard base while the soft acid tends to bond with soft base. As Al^{3+} belongs to hard acid category, so it tends to bond with hard base. Oxygen is harder base compared to sulfur so, in nature, ore of aluminum is Al_2O_3 as in accordance with HSAB principle.

Solution 2.

Xanthine oxidase enzyme carry out the oxidation of xanthine to uric acid. It has two molybdenum atoms, four Fe_2S_2 and FAD (Flavin Adenine Dinucleotide) molecules. Each molybdenum atom is surrounded by one oxygen and three S atoms.

Solution 3.

There are four atomic orbitals- one s and three p, in the valence shell of carbon, while each of the four hydrogen atoms possesses one orbital in its valence shell. So, there will be total eight atomic orbitals and eight molecular orbitals.

Solution 4.

He > Ar > Kr: Group 8(A)(18) – IE decreases down a group

Te > Sb > Sn: Period 5 elements – IE increases across a group

Ca > K > Rb: Ca is to the right of K; Rb is below K

Xe > I > Cs: I is to the left of Xe; Cs is further to the left and down one period.

IE decreases as you proceed up in a group; IE increases as you go across a period.

Solution 5.

In $[\text{Co}(\text{NH}_3)_6]^{+2}$ and in $[\text{Co}(\text{OH})_6]^{+4}$, Co is in +2 oxidation state. Its configuration will be $[\text{Ar}]3d^74s^0$. Its d orbital configuration will be $t_{2g}^5 e_g^2$. It does not have completely vacant orbital to accept electron pair. In the first complex, NH_3 is a sigma donor ligand only, so, it will form one coordinate bond only. While in second complex, OH^- is a sigma donor and pi donor both but Co^{+2} does not have vacant space to accept pair of electrons. So, there is no chance of MLCT and LMCT, still these complexes are coloured, due to d - d transition only.

Solution 6.

Since the 4f orbitals are deeply buried the Lanthanides do not take part in Π bonding and are poor- Π donors. Therefore, the Π -acceptor Ligands like CO, PPh_3 etc. do not form stable complexes with them.

Solution 7. The total no. of fine and hyperfine lines from high spin Mn (II) complex,

$$l = \frac{5}{2}$$

Number of fine lines

$$= \text{No. of unpaired } e^- \text{ s in Mn} = 5$$

No of hyperfine lines

$$= \text{No. of unpaired } e^- \text{ s} \times (2nl + 1)$$

$$= 5 \times \left(2 \times 1 \times \frac{5}{2} + 1 \right)$$

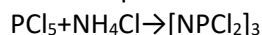
$$= 5 \times 6$$

$$= 30$$

5 and 30

Solution 8.

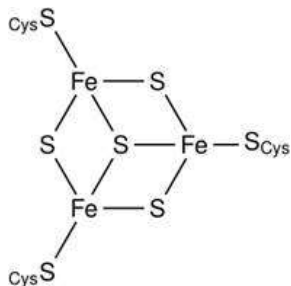
Polyphosphazenes contain more than two -P=N- groups. The preparation of triphenylphosphazene can be represented as follows:



The above reaction takes place in the presence of a halo hydrocarbon solvent at a temperature range of 120-150°C.

Solution 9.

Hapticity is defined as no. of donor atoms of the given ligands attached to the metal in a contiguous manner.



In this structure, only one atom of the ligand that is S is attached to metal only. So, hapticity of S in Fe₃S₄ is 1.

Solution 10.

Gunmetal is composed of 88 percent copper, 10 percent tin, and 2 percent zinc and is used for gears and bearings that are to be subjected to heavy loads and low speeds.

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