

Important Questions on Inorganic Chemistry- Part IV



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- When it comes to the bonding of the ligands Me_3N and Me_3P with the metal ions Be^{2+} and Pd^{2+} , the accurate statement is,
 - The ligands bind equally strong with both the metal ions as they are dicationic.
 - The ligands bind equally strong with both the metal ions as both the ligands are pyramidal.
 - The binding is stronger for Me_3N with Be^{2+} and Me_3P with Pd^{2+} .
 - The binding is stronger for Me_3N with Pd^{2+} and Me_3P with Be^{2+} .
- The oxy form of hemocyanin is in colour with wave no. Of O-O bond at ...
 - Blue, 755cm^{-1}
 - Blue, 1160cm^{-1}
 - Violet pink, 755cm^{-1}
 - Violet pink, 1160cm^{-1}
- With respect to the covalent character, following is the correct option:
 - $\text{CuCl}=\text{NaCl}$; $\text{AgCl} > \text{KCl}$
 - $\text{CuCl} < \text{NaCl}$; $\text{AgCl} < \text{KCl}$
 - $\text{CuCl} > \text{NaCl}$; $\text{AgCl} > \text{KCl}$
 - $\text{CuCl} > \text{NaCl}$; $\text{AgCl} = \text{KCl}$
- Give correct order for Ionisation potential of following:
B, Be, N, O, F, Ne
 - $\text{Ne} > \text{F} > \text{O} > \text{N} > \text{B} > \text{Be}$
 - $\text{Be} > \text{N} > \text{B} > \text{Ne} > \text{F} > \text{O}$
 - $\text{B} > \text{Be} > \text{O} > \text{N} > \text{F} > \text{Ne}$
 - $\text{Ne} > \text{F} > \text{N} > \text{O} > \text{Be} > \text{B}$
- The number of microstates for d^5 electronic configuration is:
 - 21×6^3
 - 14×6^3
 - 7×6^2
 - 28×6^3
- The correct statement amongst the following is/are:
 - Only U and Th occur naturally in significant quantities among actinoids.
 - Base strength and solubility increase on crossing lanthanide series.
 - The coordination no. of $[\text{La}(\text{NO}_3-\text{O}, \text{O}')_6]^{3-}$ is 6.
 - $[\text{Ce}(\text{CO}_3-\text{O}, \text{O}')_5]^{6-}$ is a 10-coordinate species.
 - i, ii, iv
 - i and iv
 - ii and iii
 - Only iii
- The compound $\text{HMn}(\text{CO})_5$ will show how many peaks in ^1H NMR.
(Given for Mn, $I = 5/2$)
 - 6 peaks, sharp
 - 6 peaks, broad
 - 2 peaks, sharp
 - 2 peaks, broad
- Among the following, the incorrect statement about SiC is that
 - it is known as corundum
 - It is prepared by reducing quartz with a slight excess of coke in an electric furnace at $2000 - 2500^\circ\text{C}$.
 - Pure SiC is almost colorless or pale yellow.
 - Its hardness is slightly less than diamond.
- Which of the following is true for $[\text{ML}_n(\text{CR}_2)]$, where M is transition metal, L is ligand and CR_2 is a Schrock carbene?
 - L is a pi acceptor ligand.
 - R is a pi donor ligand.
 - Carbon centre is nucleophilic.
 - Metal M is in a low oxidation state.
- Ce^{3+} is colorless but show absorption in UV region due to:
 - f-f transition
 - Charge transfer
 - d-f transition
 - f-d transition

Answer Key

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

Solutions

Solution 1.

According to Pearson's HSAB principle, hard acids prefer binding to the hard bases to give ionic complexes, whereas the soft acids prefer binding to soft bases to give covalent complexes. NMe_3 is a hard ligand while PMe_3 is a soft ligand. Therefore, NMe_3 binds with hard acid (metal ion) Be^{2+} and PMe_3 binds with soft acid (metal ion) Pd^{2+} .

Solution 2.

Hemocyanin is a non-heme oxygen transport protein. Unlike its name, it does not have neither heme group nor cyanide group. It exists in two forms –oxy and deoxy. The oxy form of hemocyanin is blue in colour due to LMCT from O_2^{2-} to Cu^{2+} . In this, peroxide is present, so its wave no. is 755cm^{-1} .

Solution 3.

Referring to the Fajan's Rule,

Ag^+ has $18e^-$ in valence shell, which is pseudo inert gas electronic configuration.

K^+ has inert gas electron configuration.

So, $\text{AgCl} > \text{KCl}$

Similarly, Cu^{+1} is $3s^2 3p^6 3d^{10}$ which is 18 electrons, pseudo inert gas electron configuration.

Na^+ is $2s^2 2p^6$ which is 8 electrons, inert gas configuration.

So, $\text{CuCl} > \text{NaCl}$

Solution 4.

Be	B	N	O	F	Ne
$2s^2$	$2p^1$	$2p^3$	$2p^4$	$2p^5$	$2p^6$

In each period, the IP of inert gas is maximum. So, Ne has maximum IP here.

So, order becomes $\text{Ne} > \text{F} > \text{N} > \text{O} > \text{Be} > \text{B}$

Solution 5.

Since we know that-

$$\left| \frac{n}{r} \right| = \frac{n!}{r!(n-r)!}$$

Where, n = twice the no. of orbitals

And r = no. of unpaired electrons

So, for d^5 configuration:

$$\text{No. of microstates} = \frac{10!}{5!(10-5)!} = 7 \times 6 \times 6 = 7 \times 6^2 = 252$$

Solution 6.

i and iv statements are correct because-

i) Uranium and Thorium are the naturally occurring actinoids that occurs in significant amount amongst all the actinoids.

iv) $[\text{Ce}(\text{CO}_3\text{-O}, \text{O}')_5]^{6-}$ is a 10-coordinate species because CO_3 has two coordinating sites $\text{CO}_3\text{-O}$, O' so it is a bidentate ligand and 5 such ligands will coordinate through 10 sites. So, the coordination number will be 10.

ii and iii statements are incorrect because-

ii) base strength and solubility decrease on crossing lanthanoid series because

1. size decreases and covalent character increases while we move from La to Lu.
2. more is hard-hard/ soft-soft interactions more is stability and less is solubility.

iii) $[\text{La}(\text{NO}_3\text{-O}, \text{O}')_5]^{6-}$ is a 12-coordinate species because NO_3 has two coordinating sites $\text{NO}_3\text{-O}$, O' so it is a bidentate ligand and 6 such ligands will coordinate through 12 sites. So, the coordination number will be 12. So, coordination no. of $[\text{La}(\text{NO}_3\text{-O}, \text{O}')_6]^{3-}$ is 6 is an incorrect statement.

Solution 7.

As Mn is NMR active, it will interact with H and No. of peaks will be given by $2nI+1$

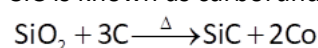
$$I = 5/2$$

$$\text{Peaks} = 2 \cdot 1.5/2 + 1 = 6$$

And as $I > 1$, the peaks will be broad. Thus, the answer is (B).

Solution 8.

SiC is known as carborundum



Pure SiC is almost colorless or pale yellow. Mohr's hardness of carborundum: 9 – 9.5, Diamond : 10

Solution 9.

In Schrock carbene, carbene carbon is electron rich due to which it is nucleophilic in nature and easily attacked by electrophiles. R cannot be a pi donor ligand because they will destabilise the carbene. Here, metal atoms are electron deficient, therefore have high oxidation state. To remove electron deficiency, metal M is connected to electron donor ligands.

Solution 10.

The valence shell electronic configuration of $\text{Ce}^{3+} = f^1$. Therefore, it will show a transition from 4f to 5d. This is a huge energy gap and shows strong absorption in the UV region.

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