BYJU'S EXAM PREP

Important Questions on Inorganic Chemistry- Part VI

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1. Which of the following compound/s show LMCT band in their electronic spectra is/are:
   i. $[W(CO)_4(phen)]$ ii. $KFe[Fe(CN)_6]$
   iii. $[ReO_4]^-$ iv. $[Ru(bpy)_3]^{+2}$
   A. i and iv B. Only iii
   C. Only ii D. ii and iv

2. The correct statement/s from the following is/are for transitions
   i. In polar solvent, no shift in wavelength is observed if both the ground and excited states are polar.
   ii. Molar extinction coefficient value for d-d transition complex is 1000 $Lmol^{-1}cm^{-1}$
   iii. Energy of charge transfer transitions are higher than crystal field transitions.
   iv. Charge transfer transitions will only impart colour if it lies in the UV region.
   A. i and iii B. ii and iv
   C. i, ii and iii D. Only iii

3. The correct statement/s for glasses from the following is/are:
   i. Glass is soluble in HF ii. SiF_4 is a solid on room temperature
   iii. Flint glass are used in optics iv. Uranium glass glows in the dark
   A. i and iii B. ii and iv
   C. i, iii and iv D. Only iii

4. In complex $[Fe(\eta^5\text{-}Cp)\ (CH_2PPh_2)_2]$, the coordination number of iron atom is
   A. 6 B. 5 C. 10 D. 2

5. An electron is placed in a magnetic field of strength 1.5 T. Calculate the resonance frequency if g = 2. [$\mu = 9.27 \times 10^{-24}\ JT^{-1}$]
   A. 42 GHz B. 15 GHz C. 30 GHz D. 48 GHz

6. The metalloenzyme which hydrolysed L-arginine to L-ornithine is
   A. Arginase B. Urease C. Xanthine oxidase D. Tyrosinase

7. Identify the factor which does not affect the g values from the following:
   A. Crystal field B. Spin-orbital coupling
   C. Jahn teller distortions D. Operating Frequency

8. Which among the following has an equal value of total magnetic moment?
   A. Dy^{+3} and Ho^{+3} B. Eu^{+3} and Gd^{+3}
   C. Yb^{+3} and Eu^{+3} D. Pr^{+3} and Pm^{+3}

9. The penetrating power (R) and ionizing power (I) of α, β, ϒ rays follow the ordering
   A. $R_\beta > R_\alpha > R_\gamma$ and $I_\beta > I_\gamma > I_\alpha$ B. $R_\gamma > R_\beta > R_\alpha$ and $I_\beta > I_\gamma > I_\alpha$
   C. $R_\beta > R_\alpha > R_\gamma$ and $I_\alpha > I_\beta > I_\gamma$ D. $R_\gamma > R_\beta > R_\alpha$ and $I_\alpha > I_\beta > I_\gamma$

10. STYX code for $B_5H_5^{2-}$, B_5H_9
    A. 0223 ,4020 B. 0330,4120
    C. 3300,4020 D. 3010,4220

Answer Key

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

Solutions

Solution 1:

$KFe[Fe(CN)_6]$ - Charge transfer occurs due to the transfer of electrons from one metal ion to another metal ion. It is known as metal-to-metal charge transfer spectra.

$[W(CO)_4(phen)]$ and $[Ru(bpy)_3]^{+2}$ - Both compounds have low lying vacant π^* orbitals on the ligands which can easily accept the electrons from the metal, and they will show metal-to-ligand charge transfer spectra.

$[ReO_4]^-$ - Transfer of electrons from low lying π-orbitals of oxygen to the d-orbitals of the metal (Re) takes place and they will show ligand-to-metal charge transfer spectra.

Solution 2:

In polar solvent, no shift in wavelength is observed if both the ground and excited states are neutral because polar solvent won't be able to align its dipole moment with a neutral ground and excited states.

Molar extinction coefficient value for d-d transition complex is low as they are Laporte forbidden transitions.

Energy of charge transfer transitions are higher than crystal field transitions but will only impart colour if it lies in the visible region.

Solution 3:

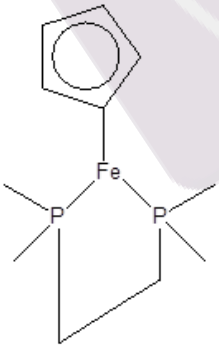
Glass contains silicon and fluoride, attacks the SiO_2 and forms strong Si-F bonds. The silicon-oxygen lattice structure will break down and dissolve in it. SiF_4 is a toxic gas with pungent odour.

Flint glasses have a high value of refractive index, so they are used in the optics.

Uranium glass is a colour glass which glows in the dark and prepared from the UO_2.

Solution 4:

The structure of $[Fe(\eta^5\text{-}Cp)\ (CH_2PPh_2)_2]$ is:



L- represented as pi donor- neutral electron contribution is 2.

X- represented as sigma-donor- neutral electron contribution is 1.

Z- represented as pi acceptor- neutral electron contribution is 1.

1 Cp ring is 5 electron donors having 2π donor as an alkene and 1 carbon is used as a sigma donor. Therefore, the Cp ring will be represented as L_2X.

$(CH_2PPh_2)_2$ contribute 2 lone pairs and represented as L_2

General formula of $[Fe(\eta^5\text{-}Cp)\ (CH_2PPh_2)_2]$ = $[FeL_4X]$.

Total 5 covalent bonds are present; therefore, it has 5 coordination number.

Solution 5:
Resonance condition for EPR absorption,
$h \times \upsilon = g \times \mu \times B$
$\upsilon = (g \times \mu \times B)/h = [(2) \times (9.27 \times 10^{-24}\ JT^{-1}) \times (1.5\ T)]/(6.626 \times 10^{-34}\ Js)$
$= 4.2 \times 10^{10}\ s^{-1} = 4.2 \times 10^{10}\ Hz = 42\ GHz$ [As s^{-1} = Hz , 1 GHz = 10^9 Hz]

Solution 6:
Arginase is a manganese-containing enzyme.
The reaction catalysed by arginase:

$$\text{arginine} + H_2O \rightarrow \text{ornithine} + \text{urea}$$

It is the final enzyme of the urea cycle.

Solution 7:
When an unpaired electron is placed in a chemical environment, such as a free radical or the crystal lattice of a transition metal ion complex. The orbital motion of the electron is highly disrupted in such a chemical environment, and orbital degeneracy is partially eliminated or quenched. The orbital degeneracy is additionally lifted by Jahn Teller distortions. For transition metals, due to the relative magnitudes of crystal field and spin-orbital coupling, the g value for a free electron deviates.

Solution 8:
Dy^{+3} and Ho^{+3} both has total magnetic moment = 10.60
Whereas, Eu^{+3} has 0 ; Gd^{+3} has 7.94 ; Yb^{+3} has 4.50 ; Pr^{+3} has 3.58 ; Pm^{+3} has 2.70.

Solution 9:
The ability of radiation to damage molecules is analyzed in terms of what is called ionizing power. The ability of each type of radiation to pass through matter is expressed in terms of penetration power. Comparing the three types of ionizing radiation, alpha particles have the greatest mass. Because of the large mass of the alpha particle, it has the highest ionizing power. That same large size of alpha particles, however, makes them less able to penetrate matter. Alpha particles have the least penetrating power. Beta particles are much smaller than alpha particles and therefore, have much less ionizing power, but their small size gives them much greater penetrating power. Gamma rays are not particles but a high energy form of electromagnetic radiation. Gamma rays are energy that has no mass or charge. Thus, they have high penetration power. They are considered to have the least ionizing power and the greatest penetrating power.
Thus, the correct order will be:
$R_\gamma > R_\beta > R_\alpha$ and $I_\alpha > I_\beta > I_\gamma$

Solution 10:
The symbols s, t, y, and x which together constitute styx code correspond to
S = no. of 3c-$2e^-$ B-H-B, bridge bonds
T = no. of 3c-$2e^-$ B-B-B bonds
Y = no. of 3c-$2e^-$ B-B bonds
X = no. of terminal hydrogen atoms (simply no. of BH_2 groups)

	$B_5H_5^{2-}$	B_5H_9
S	0	4
T	3	1
Y	3	2
X	0	0

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