

PART : CHEMISTRY

1. For the complex $[\text{Cr}(\text{ox})_2\text{Cl}_2]^{-3}$ and $[\text{CrCl}_3(\text{py})_3]$ total number of stereo isomers is respectively:
 (1) 3, 2 (2) 2, 3 (3) 2, 2 (4) 3, 3

Ans. (1)

Sol. In $[\text{Cr}(\text{ox})_2\text{Cl}_2]^{-3}$ out of cis and trans, cis isomers is optically active.
 $[\text{CrCl}_3(\text{py})_3]$ is of type $[\text{Ma}_3\text{b}_3]$ and will have fac and mer geometric isomers.

2. Amongs the following species in which number of unpaired electrons is same is :
 (1) Cr^{+2} , Mn^{+2} (2) Ti^{+2} , Co^{+2} (3) V^{+2} , Co^{+2} (4) Cu^{+2} , Zn^{+2}

Ans. (3)

Sol. $\text{V}^{+2} [\text{Ar}]3d^3$, $n = 3$
 $27\text{Co}^{+2} [\text{Ar}]3d^7$, $n = 3$

3. Determine ratio of radius of 5th Bohr's orbit for He^+ and Li^{+2}
 (1) $\frac{2}{3}$ (2) $\frac{3}{2}$ (3) 2 (4) 3

Ans. (2)

Sol. $r \propto \frac{n^2}{Z}$ or $r \propto \frac{1}{Z}$ (if n same)
 $\frac{r_{\text{He}^+}}{r_{\text{Li}^{+2}}} = \frac{3}{2}$

4. Given rate law $r = k[\text{A}]^n [\text{B}]^m$. If conc. of B is halved and A is doubled then determine ratio of final rate to initial rate
 (1) 2^n (2) 2^m (3) 2^{n-m} (4) 2^{m-n}

Ans. (3)

Sol. $\frac{r'}{r} = \frac{k}{k} \left(\frac{2}{1}\right)^n \left(\frac{1}{2}\right)^m = 2^{n-m}$

5. Given following pairs for atomic radius
 (I) $(\text{B} < \text{Al})$ (II) $(\text{Al} < \text{Ga})$ (III) $(\text{Ga} < \text{In})$ (IV) $(\text{In} < \text{Tl})$
 Among these one pair is incorrect. In, incorrect pair in +3 oxidation state element's whose ionic radius is more is having atomic number :
 (1) 13 (2) 31 (3) 49 (4) 5

Ans. (2)

Sol. $r : {}_{13}\text{Al} > {}_{31}\text{Ga}$
 where as ionic radius : $\text{Al}^{+3} < \text{Ga}^{+3}$

6. Among the following paramagnetic species are
 O_2 , F_2 , N_2 , H_2 , S_2 (vapour)
 (1) N_2 , H_2 , S_2 (vapour) (2) O_2 , S_2 (vapour)
 (3) N_2 , O_2 (4) H_2 , O_2 , S_2 (vapour)

Ans. (2)

Sol. Theory based

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7. In one L, HCl solution of pH = 1, how many liter of water should be added so that pH becomes 2 ?

Ans. (9)

Sol. Dilution formula

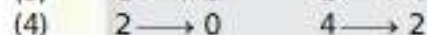
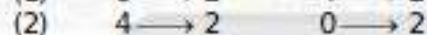
$$10^{-1} \times 1 = 10^{-2} \times V_2$$

$$V_2 = 10 \text{ L}$$

$$\Delta V = 9 \text{ L}$$

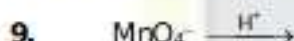
8. In lead storage battery during use what is change in oxidation number of lead at anode & cathode ?

Anode **Cathode**

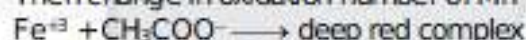


Ans. (1)

Sol. In use $\text{Pb} + \text{PbO}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{PbSO}_4 + \text{H}_2\text{O}$



Then change in oxidation number of Mn = x



In complex in configuration of Fe number of d electrons = y

Determine x + y

Ans. (10)

Sol. x = 5



Non redox reaction $26\text{Fe}^{+3} : [\text{Ar}] 3d^5$

y = 5

10. At 300 K in isothermal expansion of 1 mol of an ideal gas volume increases from 10 dm³ to 20 dm³.

Determine ΔE, W and Q

$$\left\{ R = 8.3 \frac{\text{J}}{\text{mole/K}} \right\} \quad \left\{ \log 2 = 0.30 \right\}$$

	ΔE	W	Q
(1)	0	-1720.34 J	+1720.34 J
(2)	0	+1720.34 J	-1720.34 J
(3)	+1720.34 J	-1720.34 J	0
(4)	-1720.34 J	0	+1720.34 J

Ans. (1)

Sol. $W = -2.303 nRT \log \frac{V_2}{V_1}$

$$= -2.303 \times 1 \times 8.3 \times 300 \times \log 2$$

$$= -1720.34 \text{ J}$$

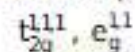
ΔE = 0 = Q + W {for isothermal process of an IG}

11. Amongst the following in which complex CFSE = 0 and spin only magnetic moment is 5.91 BM

- (1) $[\text{FeF}_6]^{4-}$ (2) $[\text{Mn}(\text{SCN})_6]^{4-}$ (3) $[\text{Fe}(\text{CN})_6]^{4-}$ (4) $[\text{Co}(\text{NH}_3)_6]^{3+}$

Ans. (2)

Sol. In Mn^{+2} (d^5) with wfl



$$\text{CFSE} = 3 \times (-0.4 \Delta_0) + 2 \times (0.6 \Delta_0) = 0$$

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12. Select incorrect statement regarding H-atom:
- (1) Probability density is highest at nucleus
 - (2) s-orbital is spherical in shape
 - (3) At a_0 (Bohr's radius) energy of electron is maximum
 - (4) 1s orbital has no radial node

Ans. (3)

Sol. Energy of electron is minimum at a_0

13. **Statement-I:** N forms with O compounds in +1 to +5 oxidation state due to $p\pi-p\pi$ bonding.
Statement-II: NC_2 cannot be formed due to unavailability of 2d subshell.

- (1) Statement I is correct but Statement II is incorrect.
- (2) Both Statement I & Statement II are correct.
- (3) Statement I is incorrect but Statement II is correct.
- (4) Both Statement I & Statement II are incorrect.

Ans. (2)

Sol. Theory based.

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